TELEPHONY

The Journal of the Telephone Industry

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SEPTEMBER 21, 1940

NUMBER 12

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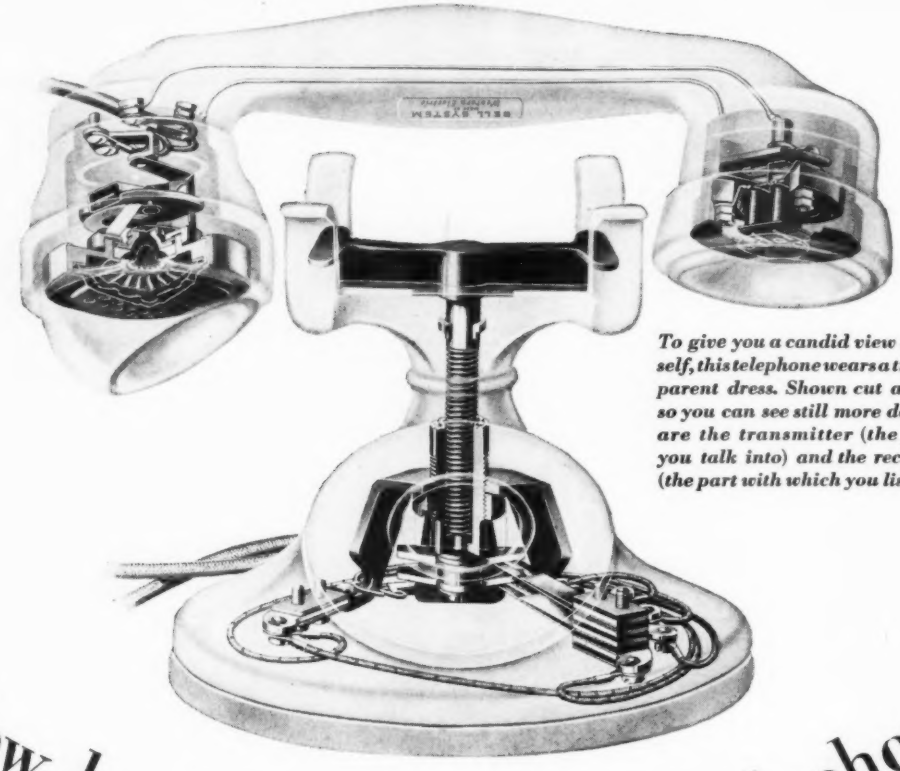

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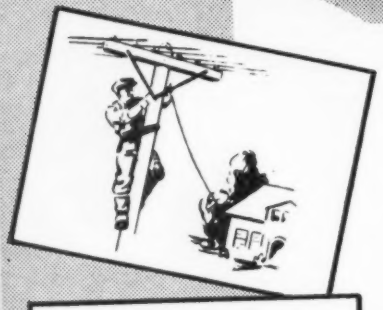

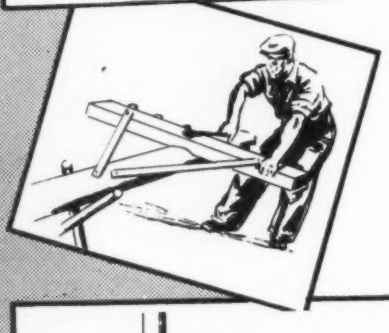

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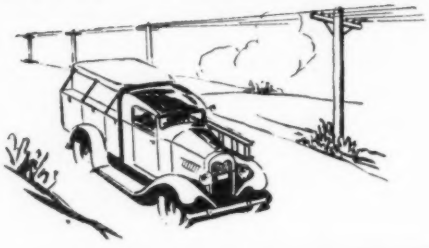

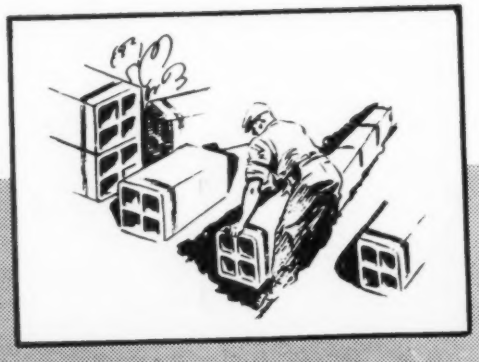

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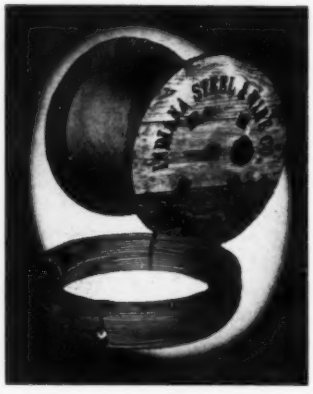

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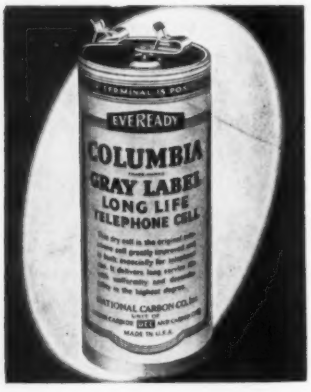

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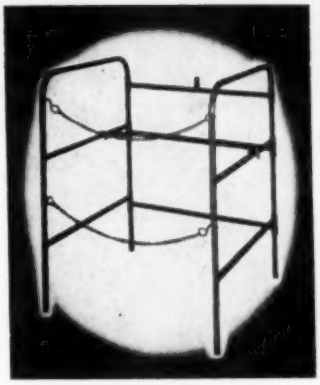

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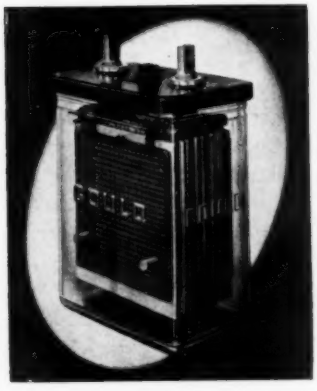

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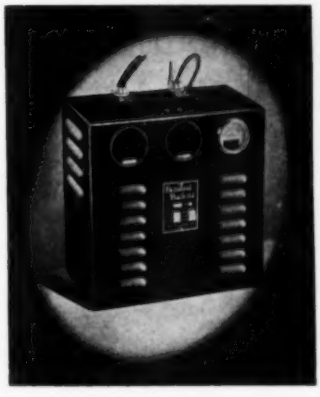

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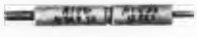

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Telephony

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DEAF SUBSCRIBERS

By D. H. TOWNSEND

WHEN SUBSCRIBERS who are hard of hearing blame the equipment for their inability to hear over the telephone, the telephone man faces a real problem. This article offers a discussion of sound and of the functioning of the ear as a guide to telephone men in "spotting" deaf subscribers and in aiding them by suggesting hearing devices

STUCK? Who wouldn't be! There's Bill Barmon, the "cronic kicker" at 12F-6 who says: "Fix my 'phone so I can hear over it, or take the darned thing out." It is the main station set he crabs about, not the upstairs extension. We have changed sets three times this year — all brand new and no defects. Yet Bill says he cannot hear; the sets all sounded excellent to us.

Now comes Kaji, the Japanese. We changed all sets on his line a few days ago, putting in new, modern, bang-up talking telephones. Kaji cannot hear. He tells us: "Old big telephone had a lot of talk, it say *plunk*, plunk! New one little speak; please, so sorry, it just say plink, plink."

There is Mrs. Waikens—her bell never rings right; cannot make it chime to suit her. It is just a lot of clatter. Old George, the blacksmith, says he cannot tell his gong from a car with screeching brakes —it just doesn't have a bit of clatter.

Next, there is Mr. Grover, who insists his telephone needs checking over. Some people do not understand him. He was talking to Mrs. Brown, commenting on her nice neat home. She thought he was talking about an ice-cream cone!

We have carefully followed every article on transmission losses—the "Nearer the Lips, the Clearer the Speech" and how to get the voice through—but have we had any schooling on just what happens when sound reaches its ultimate destination, the human ear?

Our telephones are designed, manufactured and tested by people with normal hearing, to carry voice frequencies from a little below 200 to somewhat above 4,000 cycles, usually peaked at the so-called average frequency of 1,000 cycles. We know that the frequencies from 500 to 2,500 are the most important for understanding speech. Yet those with normal hearing have never noticed the fact that reception on certain makes of telephones is better on the lower frequency bands, while other makes give greater accent to the highs.

No, they have not noticed it! It is due to the fact that with the normal human ear a considerable variation in loudness must occur before any change is noticed. Also the normal ear will fill in tonal gaps, take many things for granted; and no two ears, or sets of ears hear alike.

In testing our sets we insert a 20-db pad. We know that while volume is reduced the voice should come in clear and intelligible. Did we ever stop to think how it would sound if that 20-db loss were on the high frequency band alone? Or suppose some subscribers have a 50-db loss on lows. Have we ever made a study of the human ear, how it works, its defects, etc.? No! Yet you must admit it is a *very important* item to all telephone employes.

Consider this fact: There are in the United States today several million people who are "Hard of hearing." By this we do not mean deaf—those born without hearing or whose hearing has been totally destroyed through accident or disease. Those totally deaf could never be telephone subscribers. We do mean the deafened, those with hearing defects.

In the city of Portland, Ore., 1,300 school children show hearing defects. Portland is but one of many similar cities. These children are future telephone subscribers. Reliable authorities inform us that if all who have defective hearing wore audicles (hearing aids), the audicles would be more common than eye glasses and about as cheap.

The hard-of-hearing subscriber (deaf to you) may be difficult to locate. While he may be quick to go

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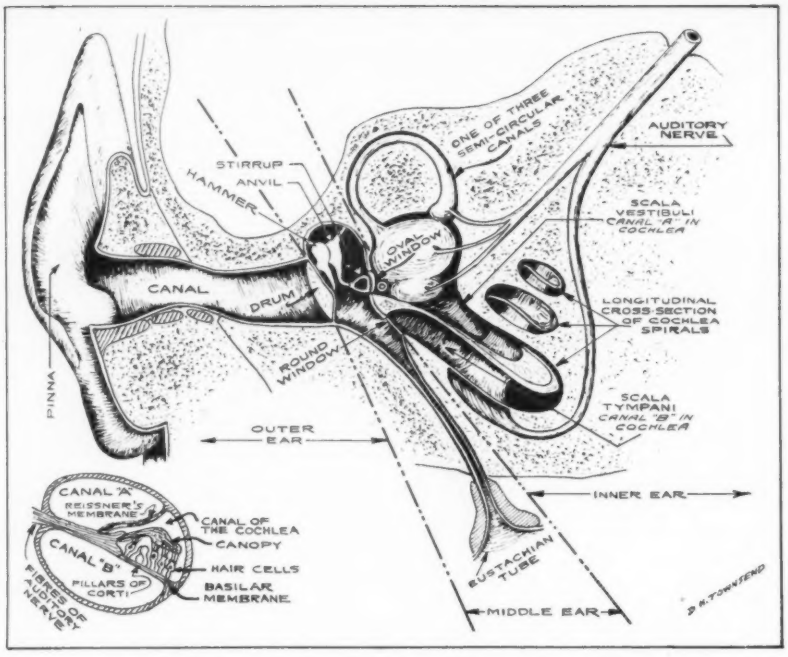

Fig. 1. A study of the text with this cross-section of the human ear will help one to understand how the proper functioning of hearing depends upon the coordination of the various parts of the ear.

to an oculist and be fitted with glasses to correct defective vision, he will do everything under the sun to escape going to an otologist and having his ears fitted with an audicle. Why? I do not know. And I have been one of the breed for more than 25 years!

Perhaps like Mrs. Waikens and George, the blacksmith, they do not realize they have tonal deafness, hard-of-hearing at certain frequencies, and truly believe the telephone equipment at fault.

Again like Kaji, the Japanese—he met but few customers face-to-face — orders for vegetables come over the telephone. His old big mongrel telephone set peaked the lower notes that he lacked; therefore, he got his *plunk, plunk!* Or Barmon—growing old and running true to form — getting deaf on the highs, naturally heard better on the extension telephone that accented these frequencies.

With others, no one knows why. They are aware of their hearing deficiency, but they will not admit it; they do everything possible to try to hide it. Possibly they believe people think because you are deaf you are dumb too. Many do—a false idea. Edison, Beethoven and scores of others belonged to the hard-of-hearing class. It is the general rule that those with impaired hearing are more efficient in their line of work than individuals with normal hearing.

Now for our own protection; to make our work easier, to cut down complaints, to satisfy and aid our deaf subscribers, let us make a little study of the human ear; how it works, its defects and items that will help it. Simplify as much as possible, but keep the technical terms in our sketch for the benefit of those who wish to get textbooks and go deeper.

Refer to Fig. 1, a cross-section of the ear. Just consider it as a picture. See how it resembles a telephone transmitter? The outer ear is the mouthpiece. The drum is the diaphragm; the middle ear with three little bones — hammer, anvil stirrup—the carbon granules. The inner ear serves as the induction coil of our set.

The auditory nerve is the line wire, carrying the voice currents to the brain. Even the Eustachian tube fits in. It equalizes pressure on the drum (diaphragm); helps prevent packing our carbon granules, similar to the slots in the threads of a mouthpiece.

The inner ear—our induction coil! Disregard the three semi-circular canals. They have nothing to do with hearing; their purpose is to control our sense of balance. In the Cochlea spirals we find the windings of our coil. Consider this as a tube, say a little over an inch long by 1/64 of an inch in diameter, wound spirally, and doubled back on itself. This tube, our primary winding, is lined with hair cells—nerve ends. These nerve ends are our secondary winding.

A fluid circulates in this tube, up from the oval window and back down to the round window. Call this fluid our primary current. The oval window, in reality no larger than a pin head, and the round window somewhat larger are diaphragms, the same as the ear drum. Call them the positive and negative poles of our talking battery.

Speak into the mouthpiece; air waves vibrate the diaphragm, which in turn moves, compresses or expands the carbon granules. The stirrup shoving against the round window causes the fluid, our primary current, to circulate in the tube. A variation of current in our primary gives us alternating current in our secondary. In our ear the hair cells are tuned to different frequencies. The fluid circulating through these cells, moves them, shakes them around, finds those tuned to the incoming vibration. These hair cells or nerve ends then transfer that vibration, or sound, on through the line wire to the brain.

Now for our troubles, our defects: Stop up our mouthpiece (plug the outer ear canal) and few or no sound waves reach the diaphragm. Dent, bend, puncture the diaphragm—have it too stiff or damping springs not properly adjusted — it does not properly respond to the voice waves reaching it; we get distorted transmission.

Pack, burn or pit the carbon (ossify or injure the three little bones, the smallest in our body) we do not vary the primary current correctly. We may have scratching, clicking, frying sounds of a "burning transmitter." Middle ear trouble!

Our subscriber probably would hear better with a bone conduction unit, a type of receiver placed against the bony structure of the skull, jumping both outer and middle ears, carrying vibrations direct to the inner ear. He may claim he hears better in a noisy place, believing noise sets the drum and bones vibrating and that the voice rides in. He is wrong! People naturally speak louder in a noisy place; try it yourself.

Perhaps our packed carbon is due to dampness, infection may have crept in through the Eustachian tube from the mouth, or the tube may be stopped.

(Please turn to page 33)

In the Nation's Capital

by Francis X. Welch

Special Washington, D. C., Correspondent for TELEPHONY

CARRIER current telephony on power lines said to be subject of experiments by REA engineers in Maryland, with a view towards its use on REA lines in rural districts for farm telephone service. . . . New communications inventions appear in the news dispatches

IT HAS BEEN known for some time that the Rural Electrification Administration has been playing with the idea of superimposing carrier circuits on power lines with the object of promoting rural telephone service. Representative Hugh Peterson of Georgia has brought the matter into the open. This was seen in a news dispatch bearing a Washington date line which was published in the Atlanta Constitution of September 7.

Of course, any telephone man will know right away that there is nothing particularly new in the employment of carrier circuits for the utilization of power lines in telephonic communications. Electric power companies and even some of the natural gas pipe-line companies have for a number of years made use of carrier circuits for restricted purposes of intra-system communication.

Furthermore, it is not known just what progress the REA research engineers have made with respect to the various technical difficulties of putting carrier circuit telephony upon a practical basis. These technical problems would have to be worked out before legal and economic problems could be approached. And all three phases — technical, legal, and economic—would have to be adequately considered before actual commercial operations could become a pressing issue.

Nevertheless, it is perhaps not too early for the Independent telephone industry to start thinking, at least, about the possibility of this telephone carrier circuit business. The REA experiments seem to be restricted so far, to one of the cooperatives in southern Maryland. It may be merely political optimism but Representative Peterson says he expects similar efforts in his home state of Georgia in the "near future." He states:

"During the past few years thousands of farm families in the first [Congressional] district [of Georgia] who were denied the blessings of electricity have, through the various REA projects, now had their homes wired and have electric lights and many of the electrical devices that decrease labor on the farm and heighten the pleasures of home life. I certainly hope the experiments now being conducted will make it possible for every farm home in Georgia to have available in the near future the many benefits of the telephone."

The newspaper story had this much more to say about Representative Peterson's statement:

"Peterson, an ardent advocate of rural electrification, has been assured by REA officials that Georgia farmers will be given first consideration in supplying rural telephone service after the tests of the new invention now under way have been completed and the devices perfected. It is uncertain how long the tests will require, but Peterson said he has been assured in person by REA officials that they have every confidence the inventions will be not only practicable but will be made available at an extremely low cost and at an early date.

"It is understood here that the farmers of Bulloch county, Georgia, have made the first organized effort in the nation to obtain rural telephone service, through the REA. Peterson is urging that every REA line in Georgia be equipped for telephone purposes in the event the invention proves a success. Such telephone service, it is understood, will not interfere with existing telephone lines, but, to the contrary, it is said, will enhance their value by making available an enormous number of additional patrons for long distance calls."

It goes without saying that if a practical method of furnishing telephone service to rural subscribers over REA power lines can be devised, it will have a certain popular appeal. The idea of using the same pole line for both electricity and the telephone on the surface, if it can be done, would strike the average citizen as an eminently sensible arrangement. Incidentally, it would double REA's prestige in the hinterlands and give that agency a good talking point when asking continued approval from Congress for REA activities.

THE SUGGESTION contained in the foregoing, to the effect that carrier circuit telephony via rural power lines would be a boon to existing telephone companies, needs a sane examination. It is true that for telephone companies operating in the larger cities and for smaller companies operating in communities outside of REA territory, the general value of the service would be increased every time a new farmer station were added to connecting telephone lines.

For the small rural telephone companies operating in areas served by REA lines (and REA is expanding constantly), the prospect of a by-

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product telephone service extended as part of a rural electrification program and financed through federal loans is something else to think about. It could help them a great deal. Again, it might not be so helpful. Much would depend upon the arrangement made for operating any such by-product service.

It should be possible, for example, to work out some arrangement whereby existing private telephone companies could take over the actual supervision, central exchange handling, and other details in connection with the telephone end of any newly-discovered dual rural utility service. In other words, telephone companies might simply use rural power lines for carriers and operate the balance of the business, terminal equipment, etc. Such a set-up might be a life-saver to many a smaller rural company.

On the other hand, what might come of this situation (if carrier circuit telephony becomes a practical development) would be REA insistence that the supervision, billing, central exchange and other matters in connection with the telephone aspects should be handled by the same non-profit farmer cooperative as controls the power lines.

Without looking for trouble, there might be an element of danger in this for the telephone industry as a whole. Such a development could be the entering wedge of public ownership into the telephone industry. Technically, these REA co-ops are private corporations. Actually, they constitute the twin brother of public ownership. Their policies and their rates are controlled by Washington.

In addition to long-term and easy financing out of the public treasury, they receive a certain amount of indirect subsidy at the expense of the taxpayer in the form of managerial and other services. In many states they are exempt from public service commission regulation. In a number of states they are even exempt from taxation.

So, getting down to a commercial basis, if the REA co-ops should go into the telephone business, their economic set-up would be hard to match. It should be added right here that your correspondent does not mean to infer that REA is engaging in these experiments with any primary intention of involving the telephone field.

Furthermore, your correspondent has not overlooked the fact that the Rural Electrification Act, as presently enacted, gives the REA no authority to lend government money for the promotion of rural telephony. Section 4 of that act, defining the power of the administration, is in part as follows:

> The Administrator is authorized and empowered, from the sums hereinbefore authorized, to make loans to persons, corporations, states, territories, and subdivisions and agencies thereof, municipalities, peoples utility districts and cooperative, nonprofit, or limited-dividend associations organized under the laws of any state or territory of the United States, for the purpose of financing the construction and operation of generating plants, electric transmission and distribution lines or systems for the furnishing of electric energy to persons in rural areas who are not receiving central station service: *Provided, however,* That the Administrator, in making such loans, shall give preference to states, territories, and subdivisions and agencies thereof, municipalities, peoples utility districts, and cooperative, nonprofit, or limited-dividend associations, the projects of which comply with the requirements of this Act. Such loans shall be on such terms and conditions relating to the expenditure of the moneys loaned and the security therefor as the Administrator shall determine and may be made payable in whole or in part out of income: . . .

Of course, statutory protection for the smaller rural telephone companies, under such circumstances, is not entirely invulnerable. Congress has demonstrated time and again that it is disposed to expand the REA program if sufficient pressure is applied by the administration. There might be more serious local legal complications for the operating rural electrification cooperatives. Many of them are restricted by their charters to the promotion of electric power service and activities reasonably incident thereto.

In all fairness it should be added to the foregoing discussion that from the standpoint of general public interest, such experiments in rural telephony by the REA are highly commendable. If REA can enrich the farmer's life by bringing him two utility services over the same wire, it is obviously a step that should be hailed as a milestone of progress. Certainly it is nothing to be condemned out of hand.

Again, it is much too early to make any bridges to cross this particular stream. But it is not too early to think about them. Adequate and timely defense is the watchword of the hour.

FRONT COVER

Happy in his work and intent on doing the best job possible, the lineman shown on the front cover typically represents plant men throughout the telephone industry. They recognize and accept their responsibility of keeping telephone poles and lines in good repair so that service to subscribers will be satisfactory at all times.

With America now preparing to build the strongest defense this country has ever known, communication assumes new importance. And the telephone industry is among the first to safeguard its plant and equipment facilities, and to call upon loyal and dependable employes for their cooperation in the task of maintaining good and uninterrupted telephone service.

SPEAKING about communications inventions which are still in the laboratory stage reminds your correspondent that he has been getting a certain amount of good-natured ribbing about an item which appeared in this department some months ago. It had to do with a "television bomb." This was described as a miniature airplane guided by radio waves through a television eye and controlled from a mother ship high above the clouds out of range of anti-aircraft guns.

Some good readers were frankly skeptical and were good enough to write in and say so. "Maybe it was just something you ate," was the thoughtful suggestion of one cynical follower of these pages.

Now comes the day of vindication. Now it can be told without the necessity for avoiding proper names, dates, or places. Dr. Lee De Forest, well-known inventor, who is often called "the father of radio," disclosed from his Los Angeles office early this month that development of a pilotless torpedo plane on which he has been working might well be completed within the year.

The device, De Forest said, would provide the United States military forces with an inexpensive means of obtaining information by aerial surveys and also would act as a robot bomber.

The torpedo plane could be made from inexpensive plastics and would require no armor because it would carry no passengers, the inventor explained. The flying could be directed by radio from a mother ship ten miles or more away and out of danger, he added. Television cameras could be placed in the nose and a bomb carried beneath the fuselage.

A television transmitter in the device could send pictures of the terrain below to the ground base and

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XUM

An Elementary Course

In Telephone Transmission

By H. H. HARRISON, M. Eng., M. I. E. E.

THIS fifth article, in the transmission series, is devoted to a discussion of some vector theorems

THERE are four fundamental rules relating to the multiplication, division, evolution, and involution of vectors.

A. Multiplication (Fig. 31).

$a/\phi \times b/\theta = ab.e^{j\phi}e^{j\theta} = ab.e^{j(\phi+\theta)}$

$= ab\ /\phi+\theta$

Thus to multiply two vectors together, multiply their sizes and add their angles.

B. Division.

$(a/\phi)/(b/\theta) = (a/b)\ e^{j\phi}e^{-j\theta}$

$= (a/b)\ /\phi-\theta$

To divide one vector by another divide their sizes and subtract their angles.

C. To raise a vector to a given power.

$(a/\phi)^2 = (a/\phi)\ (a/\phi)$ which by A is $a^2\ /2\phi$

The nth power would be $a^n/n\phi$

D. To obtain the square root of a vector.

Find $\sqrt{a/\phi}$.

Let $b/\theta = \sqrt{(a/\phi}$

Then $b^2/2\theta = a/\phi$ from which

$b^2 = a$ and $2\theta = \phi$ or $\theta = \phi/2$

Therefore, $b/\theta = \sqrt{a/\phi/2}$

The square root is obtained by extracting the root of the size of a and halving its angle. The nth root would be $\sqrt[n]{a/\phi/n}$.

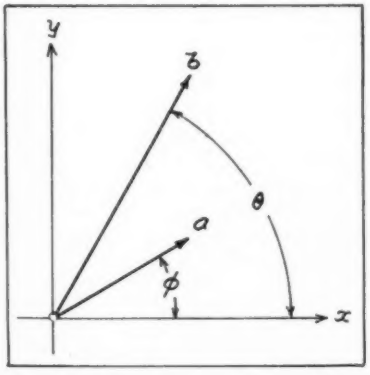

Fig. 31. To prove the rules for multiplication and division of vectors.

Vector impedances in parallel: If two impedances p and q are in parallel, their joint impedance

$$z = pq/\ (p+q) \text{ - - - } (1)$$

from which

$$z/q = p/\ (p+q) \text{ - - - } (2)$$

In Fig. 32, Z_1 and Z_2 are two impedances in parallel. Adding them vectorially OB results. Rotate the triangle OZ_2B until Z_1+Z_2 coincides with OZ_1. Draw a line from Z_1 parallel to BZ_2 cutting OZ_2 in Z. OZ is the joint impedance required.

Proof: By similar triangles,

$$Z/Z_1 = Z_2/\ (Z_1+Z_2)$$

Therefore, $Z = Z_1Z_2/\ (Z_1+Z_2)$ - - (3)

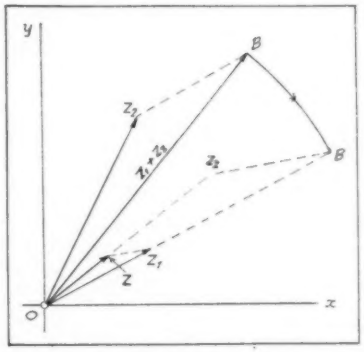

Fig. 32. Construction for obtaining the joint impedance of two vectors.

There is a special case where Z_1 is in quadrature with Z_2. Referring to Fig. 33-a the construction is the same as in the last case but Fig. 33-b shows that this can be reduced by simply joining the ends of vectors Z_1 and Z_2 and from O drawing OZ perpendicular to this line. $OZ = Z_1Z_2/\ (Z_1+Z_2)$.

Examples: In Fig. 34-a, a resistance R is in parallel with an inductance L, the reactance of which is varied either by an increase in the frequency or in L itself. Joining the two vectors—the variable and the constant one as in Fig. 33—and drawing perpendiculars, the joint impedance over a band of frequencies is obtained. The locus is seen to be a semicircle. When $\omega L =$ infinity, the joint impedance is R; when it is O, the joint impedance is O.

Fig. 34-b represents the case of a condenser K and resistance R in parallel. The construction is the same as before. With $\omega =$ O the impedance is R. With $\omega =$ infinity, K short-circuits R, the joint impedance being zero.

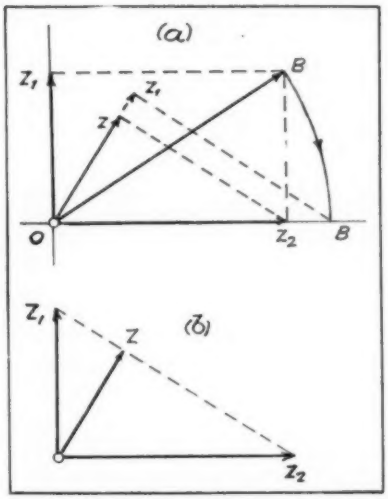

Fig. 33. Special case of the joint impedance of vectors.

An interesting case of joint impedance arises when two vectors are (a) in phase or coincident with one another and (b) 180° apart.

Referring to Fig. 35-a, vectors OA and OB are in phase. Their joint impedance can be found as follows:

Erect perpendiculars to OA at O and A as shown, and with radii OA and OB cut these in the points a and b. Join points a and b by a line which cuts the line OB at C. OC = Z is the required joint impedance.

Proof: By similar triangles,

$(OA-OC)/OC+Aa/Ob=OA/OB$ - (1)

Therefore,

$OA.OC = OB.OA - OB.OC$ - - - (2)

and $OC\ (OA+OB) = OB.OA$ - - (3)

from which,

$$OC = OB.OA/(OA+OB) \text{ - - } (4)$$

This latter is a result which could ordinarily be obtained by calculation, knowing the sizes and angles of OA and OB.

Figs. 35-b and 35-c are the two possible cases of a phase difference of 180°. In the one case OA is less than OB and in the other is greater than

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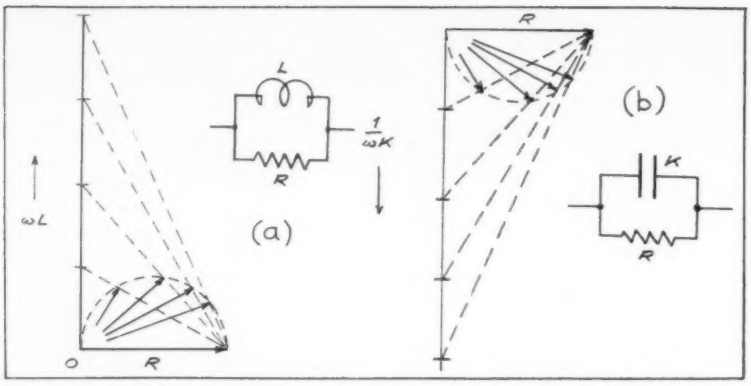


Fig. 34. Joint impedance of reactive and non-reactive elements.

OB. Both lead to the result of equation (4), but the denominator of the right-hand side of (4) is now (OA–OB) and the resulting joint impedance is, therefore, greater than either OA or OB.

The reader should experiment with both Figs. 35-a and 35-b by (1) making OA = OB, (2) increasing either OA or OB in steps while one of the two is constant and (3) increasing one while diminishing the other. The locus of the joint impedance under these conditions will supply a good deal of interesting information and it is this which justifies the use of a graphic method where, for a single set of conditions only, calculation would be just as convenient.

Graphic methods of obtaining the square root of the product of two vectors. A quantity frequently required in transmission problems is the square root of two vectors where one or both of them is varied in steps.

Referring to Fig. 36-a, if two quantities, OB = b and OA = a, are joined end to end and a semi-circle is drawn

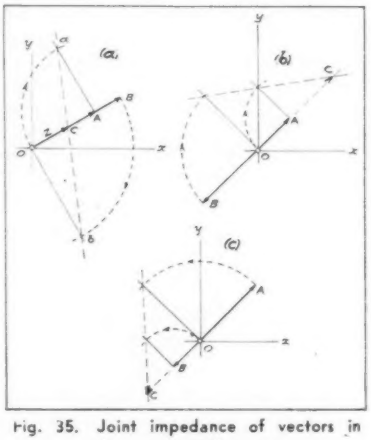


Fig. 35. Joint impedance of vectors in phase and 180° apart.

with OA + OB as a base, then the line OC perpendicular to the base is the square root of the product OA.OB.

Take two vectors, $A/\underline{\phi}$ and $B/\underline{\theta}$ (Fig. 36-b). If these vectors are arranged as in Fig. 36-c the square root of their product will be along the dotted line OC drawn from O at an angle $(\phi + \theta)/2$ to the OX axis.

The principle of Fig. 36-a may now be applied to obtain the square root of the product. Draw a line aOa perpendicular to Oc. With radius OB mark off Oz_2 on line aOa, and with radius OA mark off Oz_1 on line aOa. z_2z_1 is the base line of the semi-circle and bisecting this at P and drawing the semi-circle, the intersection of the latter with OC at Q gives the numerical value of $\sqrt{AB}$.

If a vector traverses a path parallel to a line drawn through the origin and at right angles to the vector in its initial position so that $y = A + pB$ where B is a constant and p a variable, then

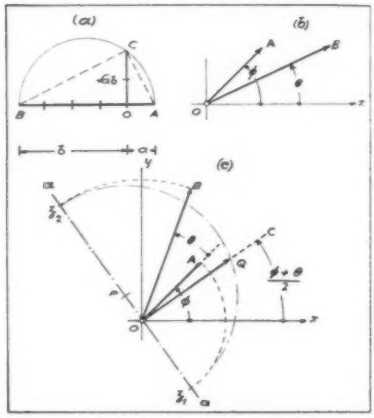


Fig. 36. Construction for obtaining the square root of the product of two vectors.

the locus of the square root of successive values of the vector is a rectangular hyberbola having as its assymptotes lines bisecting the angle between the initial direction of the vector and the perpendicular line through the origin.

Thus in Fig. 37-a the angle between A and O (infinity) is 90°. The square root of a vector, say A_1, is $\sqrt{A}/\theta/2$. The maximum angle which a vector A sweeping out a straight line could reach would be 90°, but this would require pB to be infinity. The square root of such a vector would have as its angle $90°/2 = 45°$.

Fig. 37-b is the locus of the square roots of A as it ascends the vertical line pB. The square root locus will only touch the assymptote when $\sqrt{A}$ = infinity. That the locus is a rectangular hyperbola can be proved very readily.

Referring to Fig. 38, the vector Z/ϕ and its square root $\sqrt{Z}/\phi/2$ are drawn. Through the path of vector Z is set up a perpendicular to Ox at H. If the locus of $\sqrt{Z}$ is a rectangular hyperbola, its equation will be $xy =$

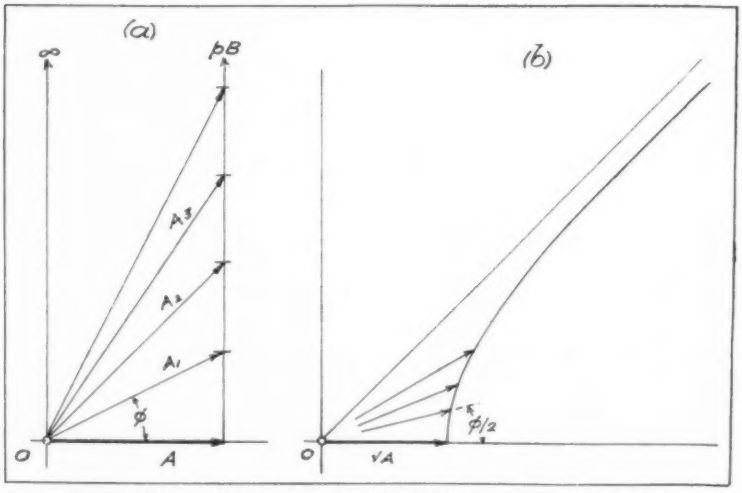


Fig. 37. Showing that the locus of $\sqrt{(A+pB)}$ is a rectangular hyperbola.

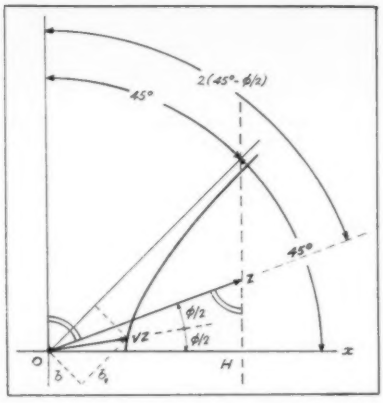


Fig. 38. Proof that the locus of $\sqrt{(A+pB)}$ is a rectangular hyperbola.

constant. If any vector, such as $\sqrt{Z}$, is projected onto the two assymptotes of the hyperbola, it will be sufficient to prove that such a rectangle as $b \times b_1$ has an area equal to some constant.

$b/\sqrt{Z} = \sin(45-\phi/2)$ - - - - - - (1)

$b_1/\sqrt{Z} = \cos(45-\phi/2)$ - - - - - - (2)

Therefore,

$b \times b_1 = Z \sin(45-\phi/2) \times \cos(45-\phi/2)$
$= (Z/2) \sin 2(45-\phi/2)$ - - - (3)

Note: $\sin(A+A) = \sin A \cos A + \cos A \sin A = 2 \sin A \cos A$

Therefore,

$\sin A \cos A = (1/2) \sin 2A$

Further,

$OH/Z = \sin(90-\phi)$ and

$OH = Z \sin(90-\phi) = Z \sin 2(45-\phi/2)$

Equation (3) becomes $OH \times (1/2) = \text{constant}$. - - - - - (4)

The same result will obviously be obtained for any rectangle formed with any value of $\sqrt{Z}$ as its diagonal.

Inversion: If a circle passes through the origin of the co-ordinates x, y, and its diameter lies on the x axis, its inversion will be a straight line.

Referring to Fig. 39, OA rotates and stretches so that its free end is always on the line C. $OA_1 \times OA$ is constant wherever A is situated on the straight line. OA_1 and OA are said to be inverse to each other and $A_1 = 1/A$ or $A = 1/A_1$. The reciprocal of the circle OC_1B_1 is the straight line BC i.e. a circle with an infinite radius.

In the case shown, $0.8 \times 1.25 = 1$. 1 is called the inversion constant and O the inversion center; A_1 and A are called the corresponding points. Any angle such as OA_1B_1 will be a right angle. Therefore, triangle B_1A_1O is similar to triangle ABO and $OA_1/OB_1 = OB/OA$. Hence for any line OA, $OA_1 \times OA = OB_1 \times OB = 1$. Therefore, a circle passing through the inversion center is the inverse locus of a straight line.

An immediate application of this is the finding of the locus of the conductance of a variable impedance.

If there is an impedance $Z\underline{/\phi}$, its conductance will be $(1/Z)\underline{/-\phi}$. If then $Z = a + jb = A + pB$ and p is given values 0,1.2, . . . n, the free end of the vector will traverse a straight line perpendicular to A.

A semi-circle drawn on A as a base will give values for 1/Z and if these

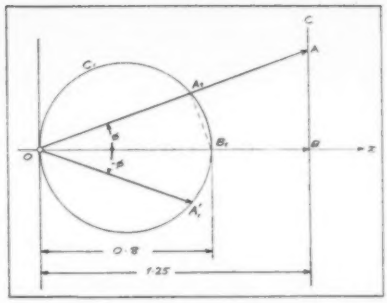


Fig. 39. Showing that the inversion of a straight line is a circle.

are transferred to a similar semi-circle, the latter will give the locus of $(1/Z)\underline{/-\phi}$. $1/A = A$ in this case because in the diagram A represents unity to scale. If A had been 2, for example, then 1/A would be 1/2, the diameter of the inversion circle.

If B is constant and A is varied, then $Z = pA + B$ and the diagram of Fig. 40-b results.

If the vectors $1/(A + pB)$ are multiplied by a constant vector $a + jb$, a further circle is produced whose diameter is increased in the ratio $1/(A + pB)$: $[1/(A+pB)] \times (a+jb)$ and the resultants are all rotated counterclockwise through an angle $\phi = \tan^{-1}(b/a)$.

The inversion process may be used to obtain the joint impedance of two impedances Z_1 and Z_2. In Fig. 41 the joint impedance of $Z_1\underline{/\phi}$ and $Z_2\underline{/\theta}$ is attained by inverting them, thus obtaining their admittances Y_1 and Y_2. The

Fig. 40. Inversion of $A+pB$ and $pA+B$.

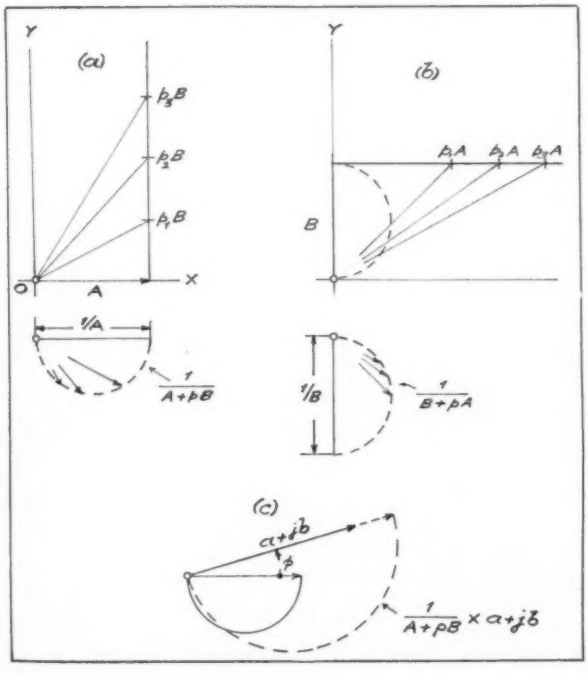
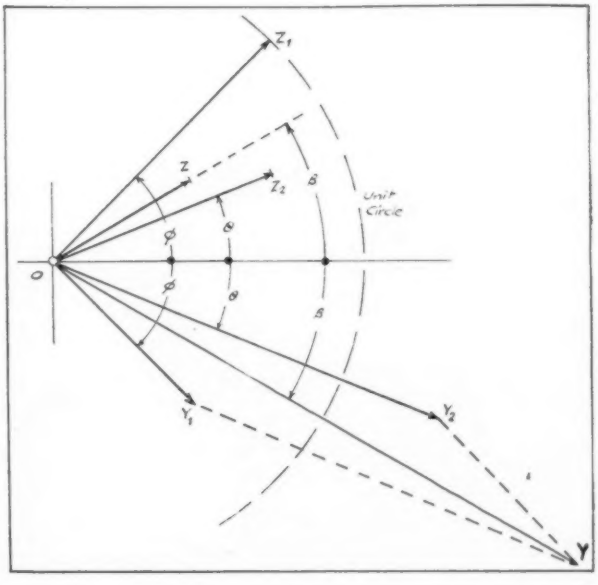


Fig. 41. Obtaining the joint impedance of two impedances by the process of inversion.



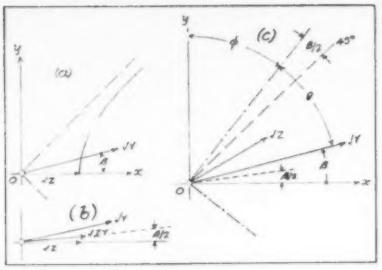


Fig. 42. Showing that the square root of the product of two vectors, one of which is constant, is a rectangular hyperbola.

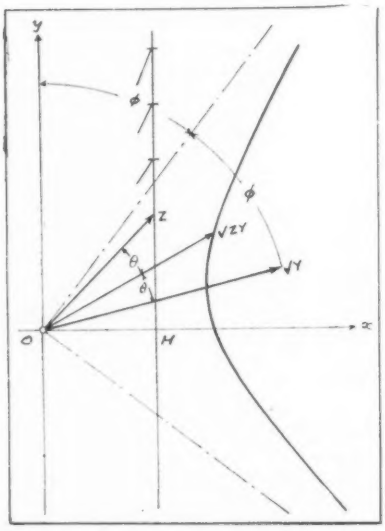


Fig. 43. Construction for $\sqrt{ZY}$ in which $\sqrt{Y}$ is constant.

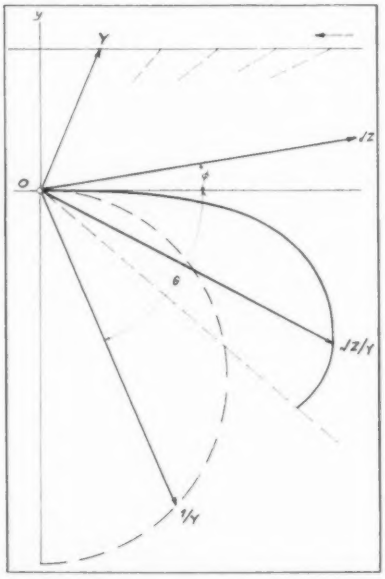


Fig. 44. Construction for the square root of the quotient $\sqrt{Z/Y}$.

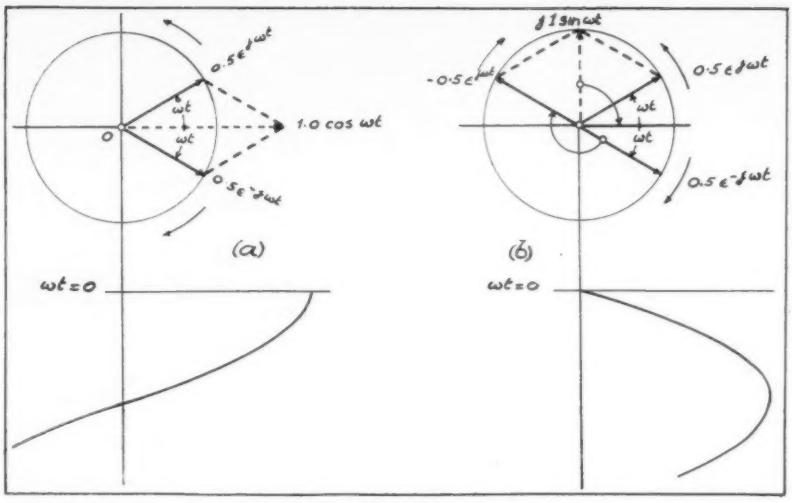


Fig. 45. Conjugate vectors.

vectorial addition of Y_1 and Y_2 gives Y, which when inverted produces $Z/\underline{\beta}$, the required joint impedance.

Square root of the product of two vectors: It is frequently necessary to obtain the expression for the square root of two vectors $\sqrt{ZY}$ one of which, $\sqrt{Y}$ say, is fixed and the other $\sqrt{Z}$ is of the form $\sqrt{(A + pB)}$. It has previously been shown that the locus of $\sqrt{(A + pB)}$ is a rectangular hyperbola. Fig. 42-a is a rectangular hyperbola which is the locus of the $\sqrt{Z}$ where $Z = A + pB$. It is required to multiply each such vector by the constant vector $\sqrt{Y}/\underline{\beta}$.

This multiplication is shown in Fig. 42-b for the initial position of $\sqrt{Z}$. Each vector terminating on the hyperbola will, therefore, be increased in the ratio of $\sqrt{Z}:\sqrt{ZY}$ and its angle increased by $\underline{/\beta}/2$. The vector $\sqrt{ZY}$ of Fig. 42-b is now the mid point of the hyperbola and the assymptotes are rotated counter-clockwise by the angle $\beta/2$. If the angle between the vertical line Oy and the fixed vector $\sqrt{Y}$ is bisected, the point of bisection will determine the position of one of the assymptotes, the other being simply drawn at right angles to this.

Referring to Fig. 42-c the angle ϕ between Oy and the assymptote is $45° - \beta/2$. The angle Θ between the assymptote and $\sqrt{Y}$ is $45° + \beta/2 - \beta = 45° - \beta/2$, therefore, $\phi = \Theta$ and the bisection of the angle $(\phi + \Theta)$ is a point through which the assymptote must pass.

Fig. 43 shows the complete construction. $\sqrt{Y}$ is the fixed vector and Z is the variable one whose locus is the vertical line through H perpendicular to the Ox axis. Bisecting the angle between Oy and $\sqrt{Y}$ gives $\phi = \phi$ and the point of intersection enables the assymptotes through O to be drawn.

Bisecting the angle between Z and $\sqrt{Y}$ and drawing a line from O through the midpoint produces a line with which the product $\sqrt{ZY}$ will coincide. The actual value of $\sqrt{ZY}$ can be calculated and this fixes one point on the hyperbola which, with the two assymptotes, is all that is necessary to establish the curve. The advantage of this construction over that of Fig. 36 is that only one calculation is necessary to obtain the locus of $\sqrt{ZY}$. No repetitive construction is required.

Square root of the quotient of two vectors: Another useful application of the hyperbola is to such expressions as $\sqrt{(Z/Y)}$. This is the product of $\sqrt{Z}$ and $\sqrt{1/Y}$ and two cases arise: one in which 1/Y is constant and Z varies, and the other where 1/Y varies and Z is constant.

In the first case the usual rectangular hyperbola is obtained. The second gives rise to a more complicated construction which is detailed in Fig. 44. Y is variable and the locus of 1/Y is a circle as shown.

The square root of the product of the expression is obtained graphically but is somewhat more troublesome than the former construction. Z is constant but Y is variable, its free end traversing the horizontal line yY. 1/Y is obtained for any value of Y by lines drawn from O at an equal but opposite angle and terminating on the circle. The products $\sqrt{ZY}(\phi + \Theta)/2$ have to be calculated and the results produce the peculiar curve shown—the lemniscate.

Conjugate vectors: Some problems in alternating currents can be very simply solved by the application of conjugate vectors.

If there is a vector $a = Ae^{j\omega t}$, then its conjugate is $Ae^{-j\omega t}$. Their sum will

(Please turn to page 32)

Everything Begins with An Idea

By JOHN S. DUFFORD

THE AGE in which we live is an opportune time for ideas. Young employes in the telephone industry should be encouraged to accept the challenge of "Everything begins with an idea"

"EVERYTHING Begins with an Idea" — here is a slogan in which lies a challenge to every young employe in the Independent telephone industry. We are living in a swiftly-changing world, a world in which new economic and social orders are being fabricated almost daily. The New Deal with its extreme policies of experimentation is touching upon every side of our lives, both at home and at work. The inferno in Europe, fortunately not at our doorstep, is nevertheless having widespread effects here.

Regardless of developments abroad, the economic output of this country will be stepped up to an ever-increasing tempo, whether to supply war equipment for abroad, war equipment for our national defense, or goods of every description for the rehabilitation of an exhausted Europe. Under these conditions, both the manufacturing and operating divisions of the telephone industry are now experiencing, and will continue to experience, increased activity.

What does all this mean in connection with the topic of this discussion—everything begins with an idea? Simply that this is an opportune time for *ideas*. Right now business is on the up-grade with the result that new experiments are being tried, new routines being put into effect, new forms to be filled out, new equipment required, etc.—in fact, hardly a day goes by without some new change turning up. In connection with this, it is axiomatic that whenever changes are made there is always room for improvement, and there's where our slogan comes in.

"Everything Begins with an Idea." Thomas A. Edison applied this basic principle to the fullest extent. He owed his success to his seemingly limitless storehouse of ideas. Originating an idea, he would start investigating, and then work ceaselessly on until he made the idea work. He summed it all up with these words, "Success is 1 per cent inspiration and 99 per cent perspiration." That 1 per cent represents *ideas;* the 99 per cent represents the necessary work required to apply the ideas.

Webster defines an "idea" as a preliminary or imperfect conception or construction. That is, an idea is merely a plan or purpose of action, and in itself is valueless until the necessary work is done to put it into practice.

Obviously, it is impossible for the average employe of a telephone company to do the 99 per cent required to work out the application of each idea conceived. Rather, the alternative to be recommended is that of submitting ideas to the employer for his consideration. When doing this, thoughts may be expressed either verbally or in writing. In general, a well-written letter will usually make a better impression.

Employes Should Be Encouraged to Offer Suggestions

The wise employer will welcome suggestions. He will give due consideration to their merit and offer an explanation of why they cannot be put into practice, if such is the case. Yes, he will go even further and encourage more suggestions, recognizing that the success of his company depends to a large extent upon the degree of cooperation and interest attained among the workers within the organization. He will appreciate the fact that an employe's ideas, although not always practicable, especially at first, will gradually mature and become an invaluable source of helpful suggestions.

You, the employe, will notice for yourself this maturing of ideas. Although most of them will meet a set-back such as "not practical," "already in use," etc., sooner or later you will click with an idea that will meet with approval and be put into practice. The feeling that this brings is both stimulating and satisfying.

Theodore Roosevelt once said: "A man who is not making mistakes is not doing anything." Likewise, a man who is not making any suggestions at all, is obviously not making any worthwhile ones. So get busy and start a *reservoir of ideas*. Make a conscious effort to spend a few minutes each day, during the evening, or better yet during the lunch period while in the atmosphere and physical surroundings of your daily work.

Look about and reflect on the processes and routines going on around you. Observe the details and try to visualize better ways and means of doing things. The start will be slow but your field of thought will broaden rapidly. Also, your sphere of contacts with other individuals in your organization will increase.

Most important of all, you will soon find yourself outgrowing your present job. You may be sure that if you show good judgment on the 1 per cent part of ideas, your employer will be quick to recognize this and you will be in line for a position entailing greater responsibility and supervision.

In the weeks and months to come, there will be greater need than ever for "pulling together" among the employers and employes of the Independent telephone industry, of which we are all so justly proud. We, the employes, can do our part by submitting more ideas—the employers can do their part by giving careful consideration to these ideas and by giving credit where it is due.

To encourage the carrying on of this program, it will indeed be a stimulating influence for us all to keep constantly in mind that "Everything Begins with an Idea."

▼ ▼

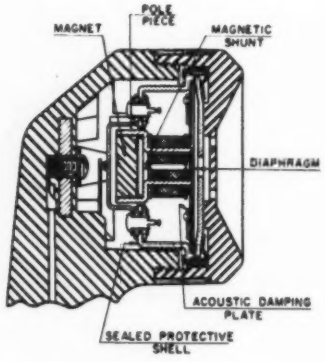
Wire Service Case Dismissed by Court

The suit of John E. Cook, operator of a racing news service in Columbus, Ohio, seeking to prevent the Ohio Bell Telephone Co. from discontinuing telephone service, was dismissed on September 4 at the request of Mr. Cook in the common pleas court.

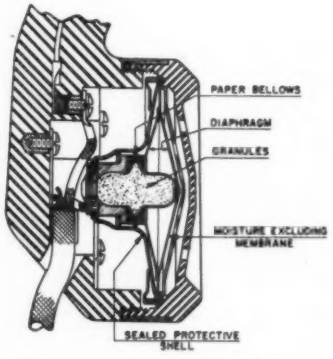
XUM

Speaking

HERE'S THE REASON:



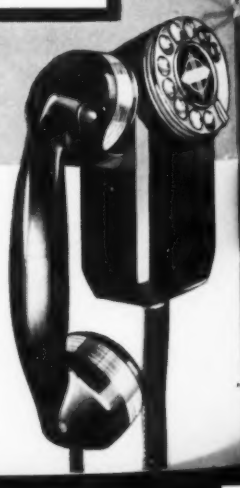
The new capsule type receiver has a more uniform response over voice frequency range, with improved response at higher voice frequencies. Note acoustic damping plate assembly, which eliminates resonant peaks in the response-frequency characteristic and prevents persistence of vibrations after driving force is removed.



The new capsule type "all positions" transmitter gives high fidelity and unusual naturalness in voice reproduction at whatever angle it may be held. The unit is moisture-proofed by means of a membrane in front of the diaphragm and a sealed closure to the granule chamber in the rear.

The type 40 Self-Contained Desk Monophone, with Automatic Dial.

The Type 50 Wall Mounting Monophone, for Manual Operation.



The Type 43 Compact Monophone, with Dial for Automatic Operation.

XUM

...ng of TRANSMISSION

These new MONOPHONES surpass all previous standards in clear, crisp enunciation and lifelike voice quality!

Here's telephoning at its best — full, natural tones that make you feel as though you're holding a face-to-face conversation, no matter how many miles of cable or open wire may intervene!

To obtain this improved transmission in the latest Monophones, our designers utilized new materials with advanced electrical and magnetic properties, and took full advantage of recent developments in electro-acoustics. The result is a lifelike quality of voice reproduction that will surprise even the most experienced telephone man—to say nothing of the average subscriber, whose satisfaction, after all, is essential to successful telephone operation.

Then, too, people like the Monophone's smooth, modern lines and lustrous finish. They find these telephones add an attractive note to home or office, and fit harmoniously into practically any decorative scheme. Why not plan to enhance the prestige and popularity of your service by equipping your subscribers with Monophones — you'll find them reasonable in cost and unequalled in reliability and long life. Write for full information—today!

If you have not yet received a copy of our new telephone catalog 4055-C, send for your copy at once! It contains illustrations and technical descriptions of latest type telephones for every operating requirement.

AUTOMATIC ELECTRIC

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THE BEST procedure for training beginner operators is a matter of deep concern for all traffic people. How one chief operator meets the problem is described in this paper, presented before the traffic conference at the Iowa convention, discussing

A Two-Weeks' Local Outline

For Training Students

By GRACE COAN
Chief Operator, Western Light & Telephone Co., Denison, Iowa.

THE TWO-WEEKS' local training outline is primarily intended for common battery switchboards. It may be used in small or large exchanges, revamped to suit local requirements. I have revamped mine to suit our local requirements several times.

We try to cover the various subjects in the outline in two weeks' time but cannot always do so. Also, we maintain no hard and fast rule for the amount that should be covered each day or week; much depends on the student and the time I have to give her. I want to hold her attention and interest and so do not either crowd her or give her so little that she will think there is nothing to the training.

We have a list of 26 calls with what happens, what to do, and what to say. These calls cover the following subjects:

(1) Test call, completed without delay. (2) One on which a second request for the number is necessary. (3) No response. (4) Local multiple call, individual line. (5) Two-party line call. (6) Four-party line call. (7) Party asks for ring on his line. (8) PBX line. (9) Vacant individual or party-line station. (10) Disconnected or changed since last directory listing. (11) Alternate station designation. (12) Local multiple call — jack-per-line party-line called as an individual line.

(13) Local multiple call—individual line called as party line. (14) Line busy. (15) Consecutive group. (16) Flashing-back supervisory signal (new call). (17) Flashing-back supervisory signal. (18) Long distance. (19) Rural call. (20) Don't answer call. (21) Bell rang report. (22) Reverting call. (23) Reverting call. (24) Wrong number reported. (25) Cutoff reported. (26) Emergency.

This outline is not a class-room instruction, but rather is used when training students at the switchboard.

When the student learns how to adjust her telephone set just right, I show her where to plug into the position at which she is seated and explain to her the correct position to assume in readiness for a call. While I am plugged in with her, I have her plug in and take one call and give the acknowledgment; I show her the called line, have her test it and then plug in and ring. Now she feels she is actually doing something.

Perhaps some of you are thinking: "Oh, that is a lot of trouble. Why not let her learn as she goes along, even if she makes mistakes?" My answer is: "When the foundation is strong, item after item planted firmly in student's mind, things that come later do not cause her to hesitate."

When the student becomes reasonably certain as to how to complete a call without delay, the multiple is explained to her. This may be done in several different ways. One way is to drill her with a multiple card, having her repeat the numbers after you as you say them and then find them on the card. Then have her do the same on a complete multiple appearance. This is the most important part of her training, so don't slight it.

Introduction of Training Outline

This outline is intended for common battery exchanges the size of Denison (about 1,200 subscribers), but it may be used in smaller or larger offices by eliminating or adding as required.

(1) Explain briefly: Hours of duty, lunch, relief periods, privacy of telephonic communication. The latter cannot be impressed too soon on a new girl, especially in very small towns where people think everybody's business is theirs.

Then the student signs the office card or record and the social security card.

(2) The student is taken into the operating room so as to impress her with the quietness and order existing with everyone attending to her own business at all times.

The switchboard comes next, so the chief operator takes up a number of items with which the student should become familiar shortly. For example, she explains the equipment, keyshelf, line signal lights; how to select a cord, open the listening key, plug into jack (answering); how to answer a line signal with "Number, please?"; acknowledge the order, test and plug into the called line if the line is not found busy.

The supervisory signals are explained—front one, light; back one, dark. The ringing keys are explained with the necessity for the student to give firm rings by holding the keys correctly. The chief operator explains how the front signal becomes dark when the called party answers. The student watches until two signals show and then the disconnect is explained. Lastly she is shown how to take connections down.

Note: If the student is able to grasp all of this in her mind, which I ascertain after several reviews, I decide whether to give her any more training for this session. I ask her to write on paper questions regarding anything she is not sure of and then go over it with her.

XUM

A SHORT STORY about LONG LIFE!

"Eveready" "Air Cell" Installations are Guaranteed to deliver a minimum of 6,000 hours of service life!

"EVEREADY" "Air Cell" Telephone Operators' Transmitter Batteries are a radical departure from old-style wet batteries. No recharging is necessary. You get them dry . . . hermetically sealed. There's no shelf depreciation. "Life" begins . . . *only when water is added!*

"Eveready" "Air Cell" batteries are clean, neat and easy to handle. They give long life and sustained voltage . . . 6,000 talking hours *guaranteed*. That's only ⅛¢ per talking hour! You can get "Eveready" "Air Cell" batteries quickly.—At leading telephone supply distributors. For longer life . . . greater savings . . . switch to these economical batteries now!

An "Eveready" "Air Cell" installation consists of two batteries—one No. T-2600 and one No. T-1600—connected in series.

NATIONAL CARBON COMPANY, INC.

specifically

GUARANTEES

that the "Eveready" "Air Cell" Telephone Operators' Transmitter Batteries, Nos. T-2600 and T-1600—when used in the telephone service for which they are designed and in connection with transmitters of modern design, and when properly installed and maintained according to directions provided therewith—will deliver a minimum of 6,000 hours at peak transmission efficiency.

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(3) The student is now assigned a telephone set and its adjustment and use explained to her; how to change from one ear to the other so as to train both ears, for it is hard to do this later. There is nothing that pleases a student more than to have this piece of equipment called hers while she is in the service. I have had operators tell me so and I recall how I felt.

Next the student is placed at a position in front of an entire appearance of multiple; later at a left-hand position, then at a right so she will become familiar with it from all position locations.

Different Kinds of Calls Given Student

CALL NO. 1. TEST CALL—completed without delay.

CALL NO. 2. Call on which a second request for the number is necessary. We explain how to handle a call on which we have to make a second request in order to obtain the number or order. I think it an excellent practice for a student to make a copy of the various calls she will encounter—what to say and do:

Call is answered, second request for the order necessary, with "What number, please?" If order is understood, repeat and add, "Thank you."

If order not understood after second request, "I am sorry. What number, please?"

If order not understood on the third request, refer the call to the chief operator.

Have the student locate the multiple jack, test, plug in and ring at prescribed intervals.

Note: It is important that the student learn to gauge ringing time-lengths accurately. Train her to count the length of intervals and rings at first.

Called station answers.

Disconnect signal received.

Disconnecting.

CALL NO. 3. NO RESPONSE: When call is answered and no response received, repeat, "Number, please?" a second time.

Change to front cord of another pair and repeat, "Number, please?" (Handle as locally instructed).

Multiple drill.

List of numbers prepared for this drill.

Have the student indicate the location of the called line by touching the rim of jack with the tip of the plug.

CALL NO. 4. LOCAL MULTIPLE CALL, INDIVIDUAL LINE:

Answering and receiving the order.

Acknowledging.

Locating the proper multiple jack.

Testing and plugging into the jack.

Ringing at prescribed intervals (10 seconds).

Called party answers.

Disconnect signal received.

Disconnecting.

CALL NO. 5. TWO-PARTY LINE:

Answering and receiving order.

Acknowledging.

How to tell a two-party line from an individual line (green underline) J and W.

Locating the number.

Testing and plugging into called line.

Ringing the called number. Emphasize the importance of ringing the proper station.

Called party answers.

Disconnect signal received.

Disconnecting.

CALL NO. 6. FOUR-PARTY LINE:

Answering and receiving the order.

Acknowledging the order.

How to tell a four-party line from a two-party line (green underline with white dot in center, W-J-R-M).

Locating the number.

Testing and plugging into called line.

Ringing the called station.

Called party answers.

Disconnect signal received.

Disconnecting.

CALL NO. 7. ORDER RECEIVED ON WHICH PARTY ASKS FOR RING ON HIS LINE:

Answering.

An unfamiliar order received as a request for a ring on party's line.

Acknowledge, "One moment, please?"

(Either show the student how to handle the call or complete it for her and tell her she will be told about how to handle it later.)

If the party does not hang up at once, say: "Will you hang up for a moment, please, while I ring?"

CALL NO. 8. PBX LINE:

Explain briefly the meaning of private branch exchange.

Answering.

Testing and plugging into the called line. Explain the use of white and red underline and the lamp-cap markings.

Demonstrate the way to test a PBX group.

Ringing the called station.

The called station answers.

A disconnect signal is received.

Disconnecting.

Explanation of Switchboard Markings and Lamp Caps: Necessity for observing marking of each line while

BIRD-SENSE

By MISS ANNE BARNES

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines.

"GOD GIVES every bird its food, but he doesn't throw it into the nest."—J. G. Holland.

Birds don't wait for the hand of God to feed them in their nests; nor for their favorite insects to crawl within reaching distance. "Bird-sense" tells them that food won't be lying around easy to pick up—that they must search for it, and in many different places. So, instead of waiting apprehensively on the threshold of their nest homes, uncertain where to go, they fly out and look for food—and *they find it!*

When winter is about due many kinds of birds migrate to climates more suitable for their well-being. But others stay. Most people are thoughtful enough to remember the birds in extremely cold weather, but the birds never depend on it. People might and do forget. So the birds just fluff their feathery coats, fly from their nests into the cold and search for food—and *they find it!*

Many human beings could profit by the example of the birds. If they just had bird-sense it would help a lot. But so many people look for external help when, actually, no amount of outside assistance can give them the same advantage as the force which lies within themselves.

"The spirit of self-help is the root of all genuine growth in the individual." Nevertheless, many folks prefer to follow a pattern which someone else has worked out. For example, an aspiring artist longs to paint a picture comparable to that of a famous master. Instead of putting the other man's masterpiece out of his mind and getting down to work on a picture of his own, he spends time and effort copying the work of the famed master.

He not only fails to become the artist he longs to be, but he enfeebles his own power to do more than copy a picture to which he cannot ascribe his name. If he but had *bird-sense* he would strike out for himself and, eventually, have to his credit a finished picture of his own creation.

MORAL: "No one can safely imitate another; nor by following in the footsteps of another can he ever gain distinction."—R. W. Clark.

Amertel

SETS NEW RECORDS IN OUTSIDE PLANT ECONOMY

INTRODUCED only about a year ago, these new high-strength telephone wires are already effecting important economies on telephone lines all over the country.

These two wires, Amertel-85 and -135, average 65 and 150 per cent stronger than the standard "BB" grade. They can be strung in longer spans. This means less investment in outside plant . . . faster completion of the line . . . lower construction costs. And because they offer much better resistance to ice and wind loads, they yield important savings in maintenance expense.

Over and above their physical advantages, Amertel-85 and -135 have better electrical characteristics—they actually show higher transmission efficiency at voice frequencies.

To protect these wires from corrosion, they are thoroughly galvanized by a special process which provides a tighter bond between the zinc and the steel base, and resists cracking or peeling.

No matter how you figure, these new high-strength telephone wires offer advantages that you can't afford to overlook. Send today for complete data. And on your next line, specify Amertel.

LOOK FOR THIS TAG. *It is placed for your protection on every coil of Amertel Telephone and Telegraph Wire.*

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

G-E TUNGAR BULBS *LAST* A LONG TIME

The 1200 hour warranty on a Tungar Bulb is usually only a good start for that bulb.

General Electric has been making Tungar Bulbs for *25 years*. That means they're *good!*

The price on G-E Tungar Bulbs is low now. Some other bulbs sell for less—but the extra service you can expect from Tungar Bulbs makes it more economical for you to say "G-E TUNGAR BULBS" when you're buying for replacement.

GENERAL ELECTRIC

XUM

COMING CONVENTIONS

South Dakota Telephone Association, Hotel Cataract, Sioux Falls, October 3 and 4.

United States Independent Telephone Association, Hotel Stevens, Chicago, October 15, 16, 17 and 18.

Independent Pioneer Telephone Association, Hotel Stevens, Chicago, October 17.

Tennessee Independent Telephone Association, Hermitage Hotel, Nashville, October 28 and 29.

Alabama Independent Telephone Association, Montgomery, October 31 and November 1.

Florida Telephone Association, November 7 and 8.

South Carolina Independent Telephone Association, Wade Hampton Hotel, Columbia, November 11 and 12.

North Carolina Independent Telephone Association, Sedgefield Inn, between High Point and Greensboro, November 14 and 15.

Virginia Independent Telephone Association, Roanoke Hotel, Roanoke, November 18 and 19.

Missouri Telephone Association, Muehlebach Hotel, Kansas City, November 18 and 19.

Kentucky Independent Telephone Association, December 3 and 4.

going toward jack. Line designated as party-line must have a letter or color. Explain use of overhead bulletin.

CALL NO. 9. VACANT, INDIVIDUAL OR PARTY-LINE:

Answering.

Acknowledging.

Locating the called number (black signal plug or red quadrant marking). Discuss how each corner of the line is associated with a particular letter or color. "126 or 126J seems to be a wrong number."

Subscriber not sure of the number: "Will you look up the number again, please?"

If subscriber seems dissatisfied with this request: "I will give you Information."

Information requested.

Established connection.

Information answers.

Disconnect signal received.

Disconnecting.

CALL NO. 10. DISCONNECTED OR CHANGED SINCE LAST DIRECTORY ISSUE:

Answering.

Call received for local line (yellow quadrant or green signal plug). Telephone number changed, disconnected, temporarily disconnected, calls transferred.

Refer to overhead bulletin. Explain.

CALL NO. 11. ALTERNATE STATION DESIGNATION:

Answering.

Call received for alternate station (green quadrant. A green quadrant means that a party-line station has two letters, the first one being "L" which is known as an alternate station designation).

CALL NO. 12. LOCAL MULTIPLE CALL —JACK PER LINE PARTY LINE CALLED AS AN INDIVIDUAL LINE:

Answering.

Call received for a party line without station designation: "126, what letter (or color) do you wish, please?"

Station designation given.

Establishing connection.

Station designation not given: "126 seems to be a wrong number" (Emphasizing station designation).

CALL NO. 13. LOCAL MULTIPLE CALL INDIVIDUAL LINE CALLED AS A PARTY LINE:

Answering.

Call received for an individual line number, but given with a party line designation: "126J seems to be a wrong number," or 126 red as the case may be. (Emphasize station designation.)

CALL NO. 14. MULTIPLE CALL—LINE BUSY:

Call answered and order acknowledged.

Locating and testing the called number.

The line is busy.

Clicking sound.

Plug in the answering jack.

Report: "The line is busy."

Calling party accepts the report.

Disconnect.

CALL NO. 15. CONSECUTIVE GROUP:

Call is received and order acknowledged for the first line of a consecutive group.

First line is busy.

All lines busy.

Retesting group.

Reporting, "The line is busy."

Disconnecting.

CALL NO. 16. FLASHING BACK SUPERVISORY SIGNAL. NEW CALL:

Call is answered and acknowledged in regular way.

Connection is established in regular way.

A flashing back supervisory signal is received. The front supervisory signal is lighted.

Operator answers, "Operator?"

Calling party asks for another number.

Disconnecting front cord.

Establishing connection to second number.

Called party answers.

Disconnect signal received.

Disconnecting.

CALL NO. 17. FLASHING BACK SUPERVISORY SIGNAL:

Call is answered and acknowledged.

Connection is established in the regular way.

A flashing supervisory signal is received.

Operator answers, "Operator?"

Calling party inquires about his call.

Operator gives report, "I will try it again."

If the call is a local multiple connection, continue to ring.

Called station answers.

Disconnect signal is received.

Disconnecting.

CALL NO. 18. LONG DISTANCE:

Answered.

An order is received for "Long Distance."

Acknowledge, "Thank You," or "I will give you Long Distance."

Method of reaching Long Distance. Use of sleeve.

Long Distance answers.

Disconnect signal is received.

Disconnecting.

CALL NO. 19. RURAL CALL:

Call answered and acknowledged.

Trunking, passing call, or completing (office practice).

Rural operator answers.

Disconnect signal is received.

Disconnecting.

CALL NO. 20. DON'T ANSWER CALL:

Call answered and acknowledged.

Establish connection and ring at 10-second intervals for one minute.

*The called station has not answered: Give the report, "I am trying to get them," and continue to ring at prescribed intervals for one minute.

The called station has not answered: Give a preliminary report, "They have not answered yet, shall I keep on ringing?"

If calling party requests that ringing continue, say, "All right, sir."

Ring for an additional minute and then report, "I am sorry, they do not answer."

A disconnect signal is received.

*In offices that have audible ringing signal omit this item.

CALL NO. 21. BELL RANG REPORT:

Answered. Calling party reports that his bell rang.

Apologize: "I am sorry, the party who called you is not on the line now."

Disconnect signal is received.

Disconnecting.

CALL NO. 22. REVERTING CALL:

Answered.

Order received for the J station on the line and acknowledged.

Disconnecting from the answering jack.

Locating the multiple jack.

Ringing.

Called party answers.

Listening.

Disconnect signal received. Disconnecting.

CALL NO. 23. REVERTING CALL:

Call is answered.

Order received and acknowledged.

Locating the multiple jack.

(Testing and the line found busy).

Examining number plate.

Requesting party to hang up, saying: "126J is on your line. Will you hang up for a moment, please, while I ring?"

(Disconnect from the answering jack and plug into multiple jack.)

Ringing.

Called party answers.

Listening.

Disconnect signal received.

Disconnect.

CALL NO. 24. FLASHING BACK SUPERVISORY SIGNAL, WRONG NUMBER REPORTED:

Call answered and acknowledged. Connection established in regular way.

Flashing-back supervisory signal is received.

Answering, "Operator?"

Calling party reports receiving wrong number.

Apologizing and verifying the number.

Number is given. Say: "I beg your pardon."

Number not given. Say: "I beg your pardon. Will you give me the number again, please?"

Acknowledge the order, "I will try to get them for you. One moment, please."

Re-establishing connection.

Listening to see if correct station answers.

Disconnect signal received.

Disconnect.

CALL NO. 25. CUTOFF REPORTED:

Answered.

Calling party reports cutoff.

Apologizing and obtaining order.

Number is given. Say, "I beg your pardon."

Number is not given, Say, "I beg your pardon," and add whichever of the following phrases is most suitable: "What is the number, please?" "From what number, please?" "With what number were you talking, please?"

Acknowledge order saying: "I will try to get them for you. One moment, please."

To reestablish connection. Called line not busy, call completed. (Called line busy. Two or three attempts made at two-second intervals).

Called station answers.

Disconnect signal received.

Disconnecting.

CALL NO. 26. EMERGENCY CALL:

Answered.

Emergency order received — ambulance or doctor, police, fire department.

Acknowledged order.

Connection established.

Referred to chief operator.

Called station answers.

Disconnect signal received.

Disconnect.

BILL McANGE

By HARRY B. MACMEAL

Bill McAnge of Tennessee,
Whose bark is on the open sea
Sailing in dreams to far-away
Uncharted islands, where the spray
Hangs like a mist of heliotrope—
Sun-kissed, star-guarded Isle of Hope.
Let slumber hang its canopy
O'er Bill McAnge of Tennessee.

We who have known him all the way,
From now 'way back to yesterday,
And felt his friendly clasp of hand,
His comradeship, can understand
That now since he has gone away
The sun will not be bright today;
The moon and stars a little dim—
Perhaps they, too, remember him.

So many things will bring to us
The memory of his graciousness;
The smile that lingered in his path
And made a pleasant aftermath
Of friendliness when he went by,
With waving hand and kindly eye.
He had a mind that always saw
His friends without a single flaw.

He was a man who played life's game
As sportsmen play it; praise or blame
Did not affect his onward press
To higher things; nor did success
Cause him to lose his courteous way
Of treating people, day by day.
And so, I think, we should not weep
For our old friend who fell asleep.

Bill McAnge of Tennessee,
Whose bark is on the open sea
Sailing in dreams to far-away
Uncharted islands where the spray
Hangs like a mist of heliotrope—
Sun-kissed, star-guarded Isle of Hope.
Let slumber hang its canopy
O'er Bill McAnge of Tennessee.

Telephones Gain in Lancaster County, Pa.

The four independent telephone companies operating wholly in Lancaster county, Pennsylvania, were serving a total of 12,076 stations through 20 exchanges at the end of 1939, according to C. E. Eaby, manager of the Denver & Ephrata Telephone & Telegraph Co. This represented a gain of 5.1 per cent in the number of stations during the year. During the same year Bell System telephones in the county, served through four exchanges, increased 974 to 21,852, a gain of 4.1 per cent.

In reviewing the station performance of the 10 companies composing the original Tri-County association, Mr. Eaby notes that red figures appeared 15 times in the monthly reports of the ten organizations, whereas losses were shown 26 times in the 1938 monthly reports. Eight companies reported a net gain of 121 stations in May, and 82 stations in June.

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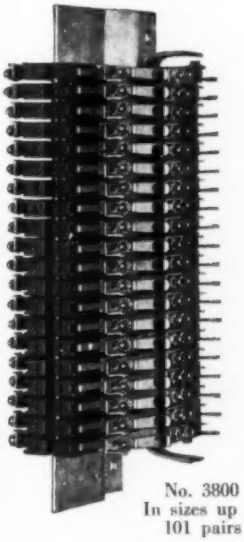

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- Operates alarm circuit.
- Provides for temporary disconnect.
- Self-soldering, low resistance heat coils easily reset without changing coil.
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TERMINAL AND PROTECTION EQUIPMENT
COOK ELECTRIC CO.
2700 SOUTHPORT AVE CHICAGO

Here and There in the Field

Telephone Company Helps in Army Maneuvers

The Northwestern Bell Telephone Co. performed so noteworthy an achievement in meeting the requirements made by army officials in staging mimic warfare in connection with annual training manuevers as to draw from Major General Bishop, speaking particularly of the aircraft warning service, this commendation sent to President A. A. Lowman:

"The thoroughness with which you tackled your end of this problem has set a fine example to all of us. The importance of demonstrating that civilians may cooperate with the army in this important task while still carrying on their normal civic duties cannot be overestimated. I am very grateful for your cooperation, which has made the successful termination of these exercises possible. I hope you will convey to each member of your organization my thanks for this important contribution to our success."

The maneuvers were the largest ever held in Northwestern Bell territory, more than 45,000 guardsmen and regulars taking part. As a result of discussions between army officers and Fred R. Kappel, assistant vice-president representing the company, a special organization was set up in Minnesota, where the army exercises were held for handling the service problems involved in maintaining communication between the various units.

Especially important was the aircraft warning service which included more than 3,000 selected civilians in a territory extending 200 miles from Little Falls, who were to watch for flights of army planes and report to army headquarters. This meant a huge task for the traffic department. It included first a survey of the company's own facilities for prompt handling of calls and also of all service stations and connecting companies. This was the first time this service was asked for by the army.

It was necessary to secure maps of every county in the area and mark on them the location of telephones and lines, as well as indicating the condition of the lines and the grade of transmission.

From these maps the army officers selected two observers for every six-mile-square township. Each observer was given a code number, and this was listed at army headquarters. Preliminary tests made it possible to evolve a smooth-working organization, on the part of both observers and operators handling the calls. These were given right of way at all times over all other calls, and when the observer said "Flash" and gave his code number he was immediately connected with aircraft warning headquarters at Little Falls, where six operators took the report on printed forms, which included information as to direction and number of planes seen.

These were passed on to another group for plotting locations on maps, and with these reports before them the army officers were able to calculate the speed and estimate probable destination. These planes came from all points of the compass.

Power companies and the federal forest service cooperated in observation work, using their lines to carry signals. In no case was there any surprise landings, so well did the service work.

As the army has its own communication setup, what was required of the telephone company was to augment their service. This included tie lines and teletypewriter networks connecting various army units with Little Falls headquarters, and also adding to regular switchboard service at that point. A three-position multiple switchboard carrying 200 lines was installed in the headquarters building, and stations were installed in leased buildings where it was not possible to use nails. Tie lines were set up to various troop concentration points, and circuits added to take care of the heavily increased load.

A PBX board was set up in headquarters building for the use of umpires, and intercommunication systems were also installed. Portable electric power was used in operating teletypewriter machines, located at various points in the occupied area. The company's portable short-wave radio telephone unit was used when units got beyond satisfactory transmission limits.

The preliminary survey for the air warning service showed that most of the telephones in the area were those of switched companies, and much of the plant was so rundown that army signal corps men had to work three weeks on 25 rural lines, replacing 3,500 poles, metallicizing 15 miles of toll circuit, transposing lines and pole lines reconditioned.

Already distinguished by having twins in his family, C. E. EABY, vice-president, general manager and director of the Denver & Ephrata Telephone & Telegraph Co., Ephrata, Pa., enjoys the pleasure of having them in the telephone business with him. DAVID R. began learning telephone work from the ground up during summer vacations from school and is now employed as a clerk in the plant department. ELIZABETH F. (called "Betty" by her friends and family) worked as operator during school vacations and after graduation from high school in 1936, but is now employed in the commercial department.

Farm Telephones Aid in Reducing Fire Loss

Few farmers stop to realize that the farm telephone has values other than its use for social and business communication, says The Michigan Farmer. For example, it has been found that one of the major uses of telephone

service is for the protection of life and property in summoning aid in case of fire, sickness and other catastrophes.

The magazine reports that a leading insurance agent in the Middle West stated not long ago that losses from farm fires in his territory have been greatly reduced because of the use of the telephone in spreading alarms to fire departments and to neighboring farmers. This agent points out that there are many cases where a farmer notifies the telephone operator of a fire and she, in turn, calls farmers nearby, who immediately go to the blaze.

It has been the observation of this insurance agent that in many instances, within five minutes after the call has been given to the telephone operator, from five to ten neighbors have arrived at the scene; that in 10 to 15 minutes, from 25 to 30 neighbors have assembled, and that in many cases it was possible for them to extinguish the blaze themselves or to hold the fire in check until a fire department truck arrived.

The Operators' Corner

By MAYME WORKMAN

Traffic Supervisor, The Illinois Telephone Association, Springfield.

MULTIPLE switchboard markings for common battery offices (fifth instalment). Series No. 418

LET'S DROP in at a typical Friday afternoon bridge party and pick up a conversation in progress:

"Mary, what a darling dress! Where in the world did you find it? It is just what I have been—(My bid? A heart)—looking for. I don't suppose you got it here?"

"Oh, yes, I did, Nelle. At Reid's dress sale last Monday. They had a chic sport dress just your style. I tried to call you from the store to tell you about it but I guess you were out. (My bid again? I'll say—what *did you* bid, partner? Well, I'll say two spades.) The operator said your telephone didn't answer. I tried to call you several times after I arrived home, but the operator said your telephone *still* didn't answer. So, I finally gave up."

"My telephone didn't answer, indeed! I haven't even had a telephone since last week. John's business—(Oh, I'll say three hearts)—has been dull the past few months and he asked me to get along without a telephone for awhile but I guess I will have to find some other way of economizing. I never realized how much I used my telephone until I tried to do without it. But it seems to me that those operators could tell people my telephone has been disconnected, don't you?"

"Yes, it does, Nelle, if they were tending to business. (Oh, did I get the bid? Now, *what did* I bid? Oh yes, spades.)"

This incident illustrates what can and frequently does occur in an exchange, where the switchboard is not marked to indicate to the operator that the desired number has been disconnected, when the subscriber no longer has a telephone. The solution to the problem is simple. Mark the switchboard in accordance with the instructions in this instalment.

The following markings are used for disconnects it calls are not to be referred to another number. If calls are to be referred to another number, the markings to be used are the same as outlined for "Change of Telephone Numbers" appearing in the third instalment of the series of articles on the subject of multiple markings (TELEPHONY of September 7).

1. "A" BOARD:

(a) *Individual and two-party (jack-per-station) stations* are pegged with a yellow signal plug, see Fig. 4-A.

If an auxiliary line is disconnected and calls are to be referred to the listed number, the condition is handled as outlined under "Change of Telephone Numbers" in the third instalment.

If an auxiliary group is disconnected and calls are not to be transferred to another number, the entire group is pegged with yellow signal plugs and the underlining is removed.

(b) *Two- and four-party (jack-per-line)* and eight-party (two jacks-per-line) stations are painted with a yellow quadrant, see Fig. 4-B.

(c) *Last station on a jack-per-line party-line disconnected* and calls are to be referred to another number:

If no yellow markings appear

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KEARNEY STRAND BANDS

Note position of band edge before bending

Straight edge is inserted into reverse bend

Crimp the seams tightly with pliers

Flatten straight edge back on itself

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Every operating company is anxious to obtain extra revenue. For those who do not now have adequate pay station coverage of their territory, we urge that they investigate Gray's complete line of Pay Station equipment. Pay Stations are proven revenue builders, and Gray Pay Stations are made for any size company and for any kind of equipment . . . magneto, common battery or automatic. Write Gray Mfg. Co. for a catalogue and prices today.

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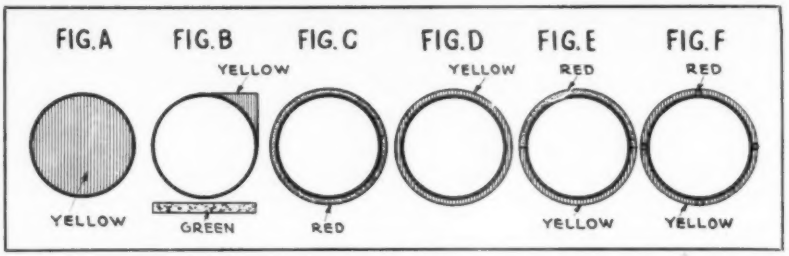

Fig. 4-A—Disconnect marking at "A" board for individual and two-party (jack-per-station) stations. Fig. 4-B—Disconnect marking at "A" board for two- and four-party (jack-per-line) and eight-party (two jacks-per-line) stations. Fig. 4-C—Multiple marking for fire alarm lines. Fig. 4-D—Marking for police alarm lines. Fig. 4-E—Marking for combined police and fire alarm lines. Fig. 4-F—State police alarm lines.

on the jack and if no temporary suffix is working on the jack, black signal plugs are used. However, if yellow markings appear on the jack, or where a temporary suffix is working on the jack, the quadrant representing the last station is painted red. All other quadrants are retained. If at a later date, the number to which calls are to be referred is disconnected, the black signal plug or red quadrant is removed and replaced with a yellow quadrant.

(d) *Last station on a jack-per-line party-line disconnected and calls are not to be referred to another number,* the quadrant representing the last station is painted yellow. All other quadrants are retained.

2. "B" BOARD:

(a) *Individual and two-party (jack-per-station) stations* are pegged with black signal plugs.

(b) *Two- and four-party (jack-per-line) and eight-party (two jacks-per-line) stations* are painted with a red quadrant.

(c) *Last station on a jack-per-line party-line disconnected:*

Black signal plugs are used. All other markings are retained. When an operator has a call for a number and she finds a switchboard marking indicating that the desired telephone has been disconnected, she passes this information to the calling party, saying for example, "278 has been disconnected."

FIRE ALARM LINES: These lines are indicated by a red circle painted around the jack, see Fig. 4-C.

POLICE ALARM LINES: These lines are indicated by a yellow circle around the jack, see Fig. 4-D.

COMBINED POLICE AND FIRE ALARM lines are indicated by placing a red semi-circle and yellow semi-circle around the jack, see Fig. 4-E.

STATE POLICE ALARM LINES: These lines are marked as shown in Fig. 4-F.

Questions from Illinois Operators

1. Should the toll center call time on long distance calls when subscriber asks to be stopped at end of three minutes?
2. How long may we hold a subscriber's local line for a long distance call?
3. When a call is not handled CLR, should the operator at the tributary pass her filing time?
4. What is the correct phrase for announcing a collect station-to-station call?
5. If a call has been canceled and the called party reports WH, should we call the calling party and ask if he wants to talk on the call?

The answers to these traffic questions appear on page 31.

Best Story of the Week—What's Yours?

Recently Mrs. T. D. Craddock of Hamilton, Texas, was busily engaged in a telephone conversation with a woman friend when a knock sounded upon the door. She completed her talk and answered the summons, to find a Western Union boy with a message. The telegram was from her husband downtown kindly asking her to hang up the receiver as he had tried for the past 45 minutes to get her on the line in order to tell her he would be gone to the country for the entire day.

Thanks go to Oscar Burton of Tyler, Texas, general manager of the Gulf States Telephone Co., for sending in this "best story." We are still wondering if either the husband or the wife got in the dog house over the incident.

XUM

Commission and Court Activities

Michigan Bell Petitions for New Rural Plan

Acting on the recommendation of farm leaders, the Michigan Bell Telephone Co. petitioned the state public service commission on August 29 for permission to institute a new liberal rural construction plan. Important provisions of the proposed plan are:

(1) No charge for construction if the number of applicants averages one per three-tenths mile of rural line extension.

(2) If the number of applicants does not average one for each three-tenths mile, a charge of 45 cents a month per one-tenth mile of construction in excess of the initial allowance with payments extending over a five-year period.

(3) Applicants would furnish private right-of-way for line extensions at no cost to the company.

(4) No charge for wire connecting the main line to the house up to 500 feet from the highway. A charge of five cents per lineal foot would be made beyond this distance.

At present, there is no charge for construction for one-third mile of rural line extension per customer. Additional construction is charged for at the rate of $300 a mile, the entire charges payable in advance. Rural customers must now pay for poles erected on their property for line connections to their home.

An additional advantage of the proposed plan, its sponsors said, is the provision for a $270-per-mile maximum charge for construction beyond the initial allowance, payable in 60 monthly installments, compared with the present maximum of $300, payable in advance.

▼ ▼

FCC Approves Omaha-Denver Dual Cable

Another link in the transcontinental telephone system is expected to become a reality following approval by the Federal Communications Commission on September 10 of a joint application by the American Telephone & Telegraph Co. and the Northwestern Bell Telephone Co. for authority to install dual all-weather cables between Omaha, Neb., and Denver, Colo., a distance of 660 miles. The estimated cost of the project, largest of its kind yet approved by the commission, is $7,635,000, of which amount $4,825,000 will be for outside plant equipment and $2,783,000 for carrier and associated equipment.

The dual Omaha-Denver cables will be plowed underground simultaneously except in metropolitan districts where they will be placed in underground conduit. This will protect the system against storms. Open-wire connections in this area are subject to ice accumulation, which has caused 19 serious interruptions to the existing out-door Omaha-Denver line in the last 12 years.

It is proposed to install a large number of type K carrier systems on the Omaha-Denver link as the need arises. Each K system will provide 12 carrier channels on each two pairs of conductors. These 12 channels may be employed for handling that many ordinary message telephone circuits, or for as many as 144 telegraph circuits. In operation each type K system would be likely to carry some telephone and some telegraph circuits. For radio network program transmission, two or three adjacent carrier channels may be combined to give a single high-quality program channel.

The route of the new cable will pass through Cheyenne, Wyo. Long-distance traffic over the present lines connecting the eastern and western portions of the country has increased rapidly, with further growth expected. The present lines connecting Denver with the cable network in the East are carrying capacity loads in their major sections.

▼ ▼

Indiana Commission Revokes Company's Permit

Revocation of the indeterminate permit of the People's Telephone Co., of Bryant, Ind., has been ordered by the Indiana Public Service Commission. It was the first permit ever revoked by the commission.

The revocation order was written by Commissioner William A. Stucky following a public hearing at which Ralph Hanna, public counsellor for the commission, presented evidence to show that service of the company was inadequate. Mr. Hanna said poor attention to service on the part of the company, which was owned by George Adams, caused a loss of customers almost to the vanishing point.

SANDS

TYPE 35 PROTECTED CABLE TERMINAL

For 11, 16, and 26 Pair Cables

Name the features that telephone men want most in a protected terminal. You'll get them all in a Type 35—including the SANDS self grounding and automatic resetting discharge block.

This block (Sands Type 2105) is standard on all SANDS protective equipment. With it, protection lapses are banished, maintenance costs are cut.

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NEW BATTERY
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Authority has been granted by the commission, city officials of Bryant, and the county commissioners to the Citizen's Telephone Co. of Decatur, Ind., to operate a 24-hour exchange at Bryant.

▼ ▼

Oklahoma Company Allowed Rate Increase

Following a hearing September 10, F. A. Cartwright, who recently purchased the Oakwood Telephone Co., at Oakwood, Okla., obtained authority from the Oklahoma Corporation Commission to increase multi-party rural telephone rates from 33⅓ cents per month to 75 cents per month. Town subscriber rates remain $2.00 per month for one-party business and $1.50 for one-party residence service.

H. W. Hubenthal, secretary of the Oklahoma Telephone Association, who represented Mr. Cartwright at the hearing, brought out testimony from the latter showing that the company, based on five months of 1940 operation, is losing about $700 a year at present rates. Even with the increase requested it would still lose $328 a year after allowing nominal salaries for himself as manager, his operator and for other necessary expenses, including taxes.

Mr. Cartwright purchased the property from the farmer-owners who had been operating it as a mutual concern. He testified that it was in bad condition when he took it over, that he has already made substantial improvements in service, and that he expects to make further improvements.

The 68 rural subscribers were paying the regular authorized switching rate of 33⅓ cents per month which applies where a telephone company does not own the lines or furnish anything but switching facilities. Mr. Cartwright testified that he now owns the rural lines and furnishes the telephone instruments to the subscribers.

B. Richardson, telephone engineer of the state commission, testified that where the company furnishes all such facilities, the usual rural multi-party rate in Oklahoma is from 75 cents to $1.25 per month and that the usual authorized rate of from 33⅓ to 41⅔ cents per month applies in Oklahoma where a telephone company furnishes only switching service and the farmers own and maintain the lines and instruments.

▼ ▼

Oklahoma Exchange Adopts Higher Rates

New and higher rates, applying to individual line telephone service, went into effect at the Fairfax, Okla., exchange of the Oklahoma Telephone Co., September 1. The new rates were authorized in an order of the Oklahoma Corporation Commission, dated August 26. They are 25 cents per month higher on one-party business and residential

ANSWERS TO TRAFFIC QUESTIONS ON PAGE 28

1. Yes. If the tributary operator passes the call to the toll center, it is her responsibility to advise the toll center operator that the calling party wishes this action taken.
2. A line may be held ten minutes while the operator is attempting to complete a long distance call. This action is necessary in order that the calling party's line will be available when the operator has reached the desired number or party at the distant point. If this action were not taken, in many cases the calling party's line would be busy when the long distance operator is ready on the call, resulting in annoyance to the called party, loss of toll circuit time and operator's time and causing unnecessary delay in completing the call.
3. Yes.
4. Say, for example, "I have a collect call for anyone from Mr. Jones at Springfield. Will you accept the charge?"
5. First explain that the call for the called party has been canceled. If the called party asks you to try the call again, tell him that the calling party may not care to talk since he has canceled his call. If the calling party still wishes the call, reach the calling station (split the connection) and say to the calling party, for example, "On your call to Chicago, Randolph 2900, Mr. Roberts wishes to know if you will talk now?" Then proceed in accordance with the calling party's wishes.

lines, with the 15 cents per month differential charge for handsets continued in force.

	Old Rates	New Rates
Business:		
One-party, wall or desk	$2.75	$3.00
Handset	2.90	3.15
Residence:		
One-party wall or desk	1.50	1.75
One-party handset	1.65	1.90

The commission fixed the undepreciated value of the Fairfax exchange at $27,305. Then, adding $1,000 for organization expenses and $1,000 for working capital, it found the present fair value for a rate base to be $29,305. Depreciation allowance fixed by the commission was 4 per cent, and 6 per cent was fixed as a fair rate of return.

▼ ▼

Summary of Commission Hearings and Rulings

Federal Communications Commission

September 10: Granted authority to American Telephone & Telegraph Co. and Northwestern Bell Telephone Co. to install twin all-weather cables between Omaha and Denver, at an estimated cost of $7,635,000.

September 10: A. T. & T. Co. and Ohio Bell Telephone Co. authorized to supplement existing facilities between Columbus and Cambridge, at an estimated cost of $222,120.

Illinois Commerce Commission

September 17: Hearing at Springfield on application of Illinois Bell Telephone Co. for authority to discontinue service to Dr. H. L. Fisher, at Hoffman.

September 17: Hearing at Springfield on joint application of the Illinois Bell Telephone Co. to sell and the Illinois Commercial Telephone Co. to purchase certain telephone property in Iroquois county.

September 17: Hearing in matter of proposed rate advances for service in all exchanges of Montrose Mutual Telephone Co. stated in rate schedule I. C. C. No. 2 of the company.

September 18: Hearing on proposed advance in rates for telephone service by Farina Mutual Telephone Co., in Farina.

September 18: Hearing on a petition of H. E. Skinner, Ella Roach, A. N. Craig and others for an order requiring the Illinois Commercial Telephone Co. to restore service, temporarily discontinued on March 28, 1940, on certain lines south from Carterville.

September 18: Hearing at Springfield on petition for an order directing the Illinois-Iowa Power Co. and the Illinois Bell Telephone Co. to remove the poles now located on Main street, north and south, and on West street, east and west, in Georgetown.

Kansas Corporation Commission

September 23: Hearing on application of East Kansas Telephone Co. to increase rates for telephone service at its Ozawkie exchange.

Michigan Public Service Commission

August 29: Petitioned by Michigan Bell Telephone Co. for permission to place in effect a more liberal rural construction plan.

Mississippi Public Service Commission

September 3: Discussion at open hearing of qualifications of prospective buyers of property of Magnolia Telephone Co., whose charter was revoked by the commission August 16.

New Hampshire Public Service Commission

September 5: Hearing on application of Fred W. Leedman to operate in the towns of Washington, Windsor and Hillsboro Upper Village. Service is being provided in these places by the Washington & Cherry Valley Telephone Co. but it has petitioned the commission to cease service October 1.

New York Public Service Commission

September 18: Hearing in the proceeding, on motion of the commission, as to certain rates, rules and regulations of New York Telephone Co. with respect to service through private branch exchanges in hotels, apartment houses and clubs.

Ohio Public Utilities Commission

September 14: Looking forward to carrying out a refinancing program, the Lorain Telephone Co. applied for authority to issue $999,000 of first mortgage, 25-year bonds to be exchanged bond for bond for the company's outstanding first mortgage 4 per cent bonds and to amortize within two years the expenses at $15,000 of the bond conversion.

Oklahoma Corporation Commission

September 10: Authority granted to F. A. Cartwright, owner of the Oakwood Telephone Co., to increase rates on multi-party rural lines from 33⅓ to 75 cents per month.

Pennsylvania Public Utility Commission

September 23: Hearing at Harrisburg on petition requesting authorization for sale of Valley Telephone Co., of Emlenton, to the People's Telephone Corp. of Butler, for $36,000.

Virginia Corporation Commission

August 30: Lee Telephone Co., of Martinsville, authorized to issue $60,000 of first mortgage 4 per cent bonds the proceeds to be used for extensions and improvements.

Wisconsin Public Service Commission

September 11: Authorized the Bangor Telephone Co. to sell its property to the Commonwealth Telephone Co., of Madison, for $52,000. The Bangor company operates exchanges at Bangor, Mindoro, and Holman, in addition to rural lines in adjacent areas.

September 23: Hearing at Madison in investigation of alleged refusal of Wisconsin Telephone Co. to extend service from its Sheboygan exchange to New Silver Lodge in section 20 of the town of Sheboygan.

October 15: Hearing on request of Commonwealth Telephone Co., to increase rates at certain exchanges named in application.

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- Ten Wire Capacity
- Maximum Sensitivity
- Ruggedly Constructed

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News Brevities

Personal

Bellevue, Ohio.—A. C. Yingling, office manager here of the Northern Ohio Telephone Co., is in Bellevue hospital with serious injuries as the result of an automobile accident which occurred recently when the Yingling automobile was struck sidewise by a car making a left turn.

Telephones

Baltimore, Md.—The Chesapeake & Potomac Telephone Co. had 294,068 stations in service at the end of August, compared with 272,950 in the same month of 1939. The gain for the first eight months of 1940 was 13,557, as against a gain of 10,500 in the like period of 1939.

New York, N. Y.—The New York Telephone Co. gained 2,694 telephones in August, compared with a gain of 109 in August, 1939.

Philadelphia, Pa.—The Bell Telephone Co. of Pennsylvania, reports a station gain of 3,397 in August, against an increase of 2,407 in the same month of 1939.

Construction

Mt. Vernon, Ind.—Edwin B. Clements has started construction of a new telephone system with the central office at San Jacinto. About 25 miles of line will be built at first, to serve about 50 to 100 subscribers. Although the first lines will be built in Jennings county, Mr. Clements hopes to extend service later into Jefferson and Ripley counties.

The switchboard will be maintained at Mr. Clements' home in San Jacinto, while long distance calls will be handled through the Mt. Vernon exchange of the Southern Indiana Telephone Corp.

Frederika, Iowa.—The new exchange of the Bremer-Butler Mutual Telephone Co. will be formally opened on September 30. With the opening of this exchange, each town in Bremer county now has its own separate set-up.

West Chester, Iowa. — The West Chester Telephone Co. plans to replace 1,500 feet of overhead line in the town of West Chester with underground cable. Work on this improvement will start about the first of October. The company, which operates about 200 telephones in Chester and vicinity, plans to continue a policy of improving its equipment.

Valley Falls, Kans.—The American Telephone Co. is installing 1,500 feet of new cable, and doing rebuilding and repair work in this vicinity.

Midway, Ky. — The new dial exchange of the Lexington Telephone Co. will be ready for operation by November, according to C. A. Moybes, local manager of the company.

The Midway exchange was until recently part of the system of the Woodford Telephone Co. That company, however, has merged with the Lexington company. Mrs. William Hughes, present chief operator, will be in charge of the new dial exchange, while Mrs. Edna Stephens will accept a position with the Versaille exchange.

Kennewick, Wash.—The city council on September 4 granted to A. F. Brown a franchise for continued operation of the Kennewick Valley Telephone Co. Mr. Brown, who has operated the system for 34 years, expects to erect a new building and install new central office equipment.

Obituary

Hooppole, Ill.—Charles W. Groves, 71, president of the Hooppole-Atkinson Telephone Co. and vice-president of the Hooppole, Yorktown & Tampico Railroad, shortest line in the state, died early September 12 in his home. Mr. Groves held numerous public offices and was a school director more than 30 years.

The widow, a son and four daughters survive.

▼ ▼

TELEPHONE TRANSMISSION

(Concluded from page 16)

be 2A cos wt, their difference j2A sin wt. In Fig. 45-a the sum of the two rotating vectors $0.5\varepsilon^{j\omega t}$ and $0.5\varepsilon^{-j\omega t}$ is the oscillating vector 1.0 cos wt on the axis of reals.

In Fig. 45-b the rotating vector $0.5\varepsilon^{-j\omega t}$ is reversed, becoming $-0.5\varepsilon^{-j\omega t}$. The sum of this vector and $0.5\varepsilon^{j\omega t}$ produces the oscillating vector j1 sin wt; and rotating this by —j, it becomes an oscillating vector on the axis of reals representing 1 sin wt.

The effective value of an alternating current is equal to that value of a steady direct current which would produce the same heating effect as the average effect of the alternating current.

The instantaneous heating effect of a current i varies as i^2. Thus, if the mean is taken of all the squares of the current values in one period of an alternating current, then the square root of this will give the effective value of the alternating current.

Let $i = 0.5I\varepsilon^{j\omega t} + 0.5I\varepsilon^{-j\omega t}$, then

$$i^2 = 0.25\ I^2\varepsilon^{2j\omega t} + 0.25\ I^2\varepsilon^{-2j\omega t} + 0.5\ I^2$$
$$= 0.25\ I^2(\varepsilon^{2j\omega t} + \varepsilon^{-2j\omega t}) + 0.5\ I^2$$

The average value of the double frequency term is obviously zero, therefore

$i^2 = 0.5\ I^2$, since the mean value of $i^2 = \sqrt{i^2}$. Then $i = (\sqrt{0.5})I = 0.707\ I$

The average power in an alternating current circuit is obtained as follows: The instantaneous power is v.i.

Let $v = 0.5\ V\varepsilon^{j(\omega t+\theta)} + 0.5\ V\varepsilon^{-j(\omega t+\theta)}$ (1)

$i = 0.5\ I\varepsilon^{j\omega t} + 0.5\ I\varepsilon^{-j\omega t}$ ..... (2)

Multiplying (1) and (2) together

$$vi = 0.25\ VI\ \varepsilon^{j(2\omega t+\theta)} + \varepsilon^{-j(2\omega t+\theta)} + 0.5\ VI\ (\varepsilon^{j\theta} + \varepsilon^{-j\theta})$$

The double frequency term has an average of zero. The second term does not vary with time but has a steady value. Hence the power varies around the average value VI cos θ.

Deaf Subscribers

(Concluded from page 10)

Let's check our talking battery; it may be weak. Some disease or other item may have injured our oval or our round window, corroded battery terminals.

If our transmitter is all right we might have induction coil trouble. In cases of mixed deafness it can be both transmitter and coil. Our coil may have some shorted turns; improper windings or high-resistance joints causing poor or distorted transmission. Extremely prolonged sounds, disease or gradual deterioration through age, may have injured or killed hair cells tuned to certain frequencies, possibly others may be overly sensitive. Thus we get tonal deafness and tonal islands, the same as had Mrs. Waikens and George, the blacksmith.

Might be why Mrs. Brown hears wrong. She hears *ice ea own* and guesses the rest. Also *own* would be all she would get of "stone" or "phone." She, unaware of her hearing defect, will blame the speaker or the telephone equipment.

Our telephone transmitter is right out in the open where we can get at it to change, adjust, repair any part, or make complete replacement. Not so with our ear—it, unfortunately is tucked away in the bony structure of the skull, one of the most inaccessible places in the body.

Science, though, has come to our rescue. Through the audiometer, a signal generator capable of producing tones of different pitch and loudness, and by audiograms (charts) the exact status of our hearing can be recorded. Thus the otologist is enabled to prescribe the proper audicle and the correct receiver, either bone or air conduction, for our particular case of deafness, just as our eyes are individually fitted for glasses. Public schools now make use of the audiometer hearing tests; so do many large industrial concerns.

Audiometer service rendered by the leading manufacturer of hearing aids is very complete. Its audiograms are not made at just certain octave points. Your hearing loss is charted in decibels from a low of 128 cycles up through the middle and in-between points on up to the highs of 4,096 and 8,192 cycles, for each ear, by both bone and air conduction, thus eliminating all guess work and showing us why the deaf subscriber set used by Mr. Johnson will not work at all for Mr. Williams.

Mr. Johnson's audiogram shows practically a straight loss through all the bands. Mr. Williams' is deficient only on the frequencies above 1,024 cycles. Therefore, the straight-line amplification of the deaf subscriber set makes the lows painfully loud, does not increase the highs enough. There is too much distortion, people are talking a foreign language to Mr. Williams—we cannot rent him the set.

If telephone manufacturers profit by the experience of hearing aid manufacturers, our deaf subscriber sets of the future will not be the bulky items now in use. The modern audicle of two vacuum tubes (some have three and four tubes), transformers, chokes, resistors, condensers, tone and volume controls and crystal microphone, has but little weight and is about the size of a spectacle case. Air conduction receivers, as efficient as our bulky operators' head receivers, are made to fit inside the ear.

Perhaps now with a little knowledge of the ear and its defects, we can spot our deaf subscribers better. We can help and guide them, for who but a telephone employe would be the most logical person to have a complete knowledge of sound?

▼ ▼

Telephones Reach New High in Columbus, Ohio

With a net gain of 473 instruments in August, and a total increase of 2,692 for the first eight months, the Ohio Bell Telephone Co. reached the grand total of 89,738, the largest number of telephones ever in service in Columbus.

POLES

B. J. Carney & Co., 100 N. 7th St., Minneapolis, Minn.—Western red cedar poles. Pentrex Butt Treated or Plain.

C. M. Christiansen Co., Phelps, Wis.—Northern White Cedar Poles, plain or butt treated. Quotations on request.

International Creosoting and Construction Co., Galveston, Texas.—Creosoted Southern Yellow Pine Poles. Plants: Beaumont and Texarkana, Texas.

MacGillis & Gibbs Company, Milwaukee, Wis.—Northern White and Western Red Cedar Poles. Plain or butt-treated. Immediate quotations on request.

T. M. Partridge Lumber Co., Minneapolis, Minn.—Northern White—Western Red Cedar Poles. Plain or butt-treated.

Valentine Clark Corporation, 2516 Doswell Ave., St. Paul, Minn.—Finished Cedar Poles. Plain or butt-treated.

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Automatic Electric No. 426 Desk sets with transmitter receiver cord and No. 24 dial complete with enclosed gong steel or Bakelite straight line signal set with three winding Anti side tone induction coil ..... @$12.00

Automatic Elec. Co. No. 21 steel hotel sets with No. 24 dial complete with anti side tone induction coil and straight line ringer $8.25; D. C. type ..... @ 7.25

Two-cell metal battery boxes 45c ea.; three cell ..... @ .55

Kellogg No. 700 type Masterphone with 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set ..... @ 17.50

Western Elec. No. 50 latest type 3-bar generator complete with crank and mounting screws ..... @ 2.75

Kellogg No. 631 C. B. Steel hotel sets with booster coil and straight line or 16-33-50 or 66 cycle harmonic ringers ..... @ 7.00

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ACCOUNTING SPECIALIST. Twenty-seven years' practical experience in public utility accounting and auditing. Telephone work a specialty. Frank M. Clark, 510 West Washington Avenue, Madison, Wisconsin. Write or telephone Fairchild 4965M for appointment.

POSITIONS WANTED

WANTED: Cable-splicing and switchboard work. Temporary or permanent job. Unemployed, will go anywhere. References as to ability and reliability. Write No. 8964, care of TELEPHONY.

WORK WANTED: Twenty years' experience managing city and small town companies, and with P. S. Commission of State. Write No. 8963, care of TELEPHONY.

WORK WANTED: Twenty years' experience managing city and small town exchanges and with State P. S. Commission. Write No. 8961, care of TELEPHONY.

HELP WANTED

WANTED: Two young high school graduates who have had one to three years' experience in telephone installation and maintenance work. Give age, experience, references and present compensation. Write No. 8962, care of TELEPHONY.

SALES representative to cover some territory in eastern states. Write giving full experience, etc. Suttle Equipment Company, Lawrenceville, Illinois.

FOR SALE

FOR SALE: Limited number of rebuilt Chatillion Dynamometers 1,000 lb. accurately calibrated. $45.00 each. Orders filled subject to stock. Iler Laboratories, 3551 Sheffield Avenue, Chicago, Illinois.

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W.E. Co. line relays 101-B—cutoff 111-A

Write for prices.

BUCKEYE TELEPHONE and SUPPLY COMPANY
COLUMBUS, OHIO

IN THE NATION'S CAPITAL

(Concluded from page 12)

the mother ship, where operators would be able to sight for bomb targets and maneuver the torpedo plane to avoid attacking fighter craft.

The inventor explained the ship would be defenseless and probably would be shot down, but it would be inexpensive and that "the cost of training pilots, not to mention the loss of life, would be saved."

AND WHILE on the subject of new communications inventions relating to military defense, we might as well hear the latest news released by the Department of Commerce here in Washington. It is the telephone air-raid warning signal, apparently developed in Sweden. The Commerce Department says that Swedish telephones are now being equipped with a simple and cheap device for indoor warnings of air-raid alarms. An electric doorbell is attached to the telephone line and rings when the voltage goes above a certain limit.

This voltage increase is performed by the watch crew of the electric works when an air-raid alarm is sounded outside and causes all alarm devices connected to the network to operate simultaneously.

The alarm signal is of one minute's duration. The increase of voltage is said to be so slight that there is no risk that electric lamps, radio apparatus or other equipment will be damaged. A large number of units are now being installed in Swedish dwellings.

▼ ▼

Prices in the Metals Market

New York, September 16: Copper—steady; electrolytic spot Conn. Valley, 11.37½@11.50; export f.a.s. New York, 9.90. Tin — steady; spot and nearby, 50.05; forward, 50.05. Lead—steady; spot, New York, 4.90@4.95; East St. Louis, 4.75. Zinc—steady; East St. Louis spot and forward, 6.85. Pig iron—No. 2, f.o.b. eastern Pennsylvania, 24.00; Buffalo, 23.00; Alabama, 19.38. Aluminum—virgin 99 per cent, 18.00. Antimony—Chinese spot, 15.00 bid. Quicksilver—175.00 @179.00. Platinum—pure, 38.00.

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